Vol. XVII, No. 6 JANUARY, 1947

THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Departments

Behind every product that is mass produced is the tool engineer

BETTER PLASTIC MOLDS

The versatile Keller at work on a plastic radio cabinet mold at Sterling Engineering Company, Winsted, Conn.

A plastic product cannot be better than its mold. Production and profit demand not only more accurate molds but speed and economy in their making. All three — economy, speed and accuracy — are supplied by "tracer-controlled milling" of the Pratt & Whitney Keller machine . . .

Many plastic molds require fine detail on side walls or in deep corners, along with minimum draft angles (sometimes only a half degree). By ordinary methods, such detail is difficult and expensive to produce. With the versatile, flexible Keller, there is no such difficulty. As the illustration shows, the fixture which carries the master and the work may be tilted or turned at an angle as needed. This does not change the relationship between master and work, or between tracer and cutter, but it does make the side walls and corners easy to reach. Result — mold designers are free from mechanical limitations in producing complicated cavities.

A Keller in your shop will turn out both volume and variety of molds. It guides itself automatically, speeds production — lowers cost. There are Keller machines in sizes and with capacities to meet any requirement. Write today for full information.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

PUBLISHED MONTHLY BY

THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

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The TOOL ENGINEER
Editorial and Advertising Offices:
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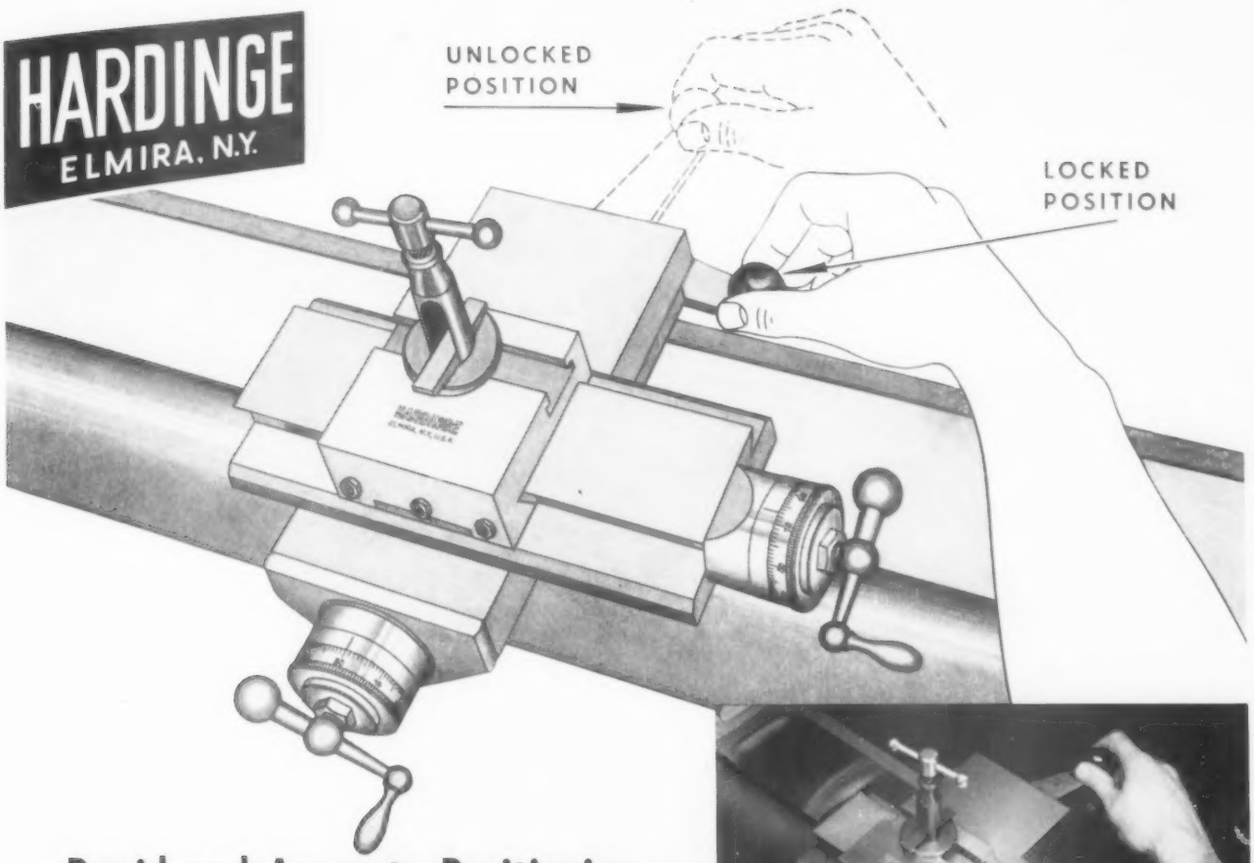
HARDINGE
ELMIRA, N.Y.

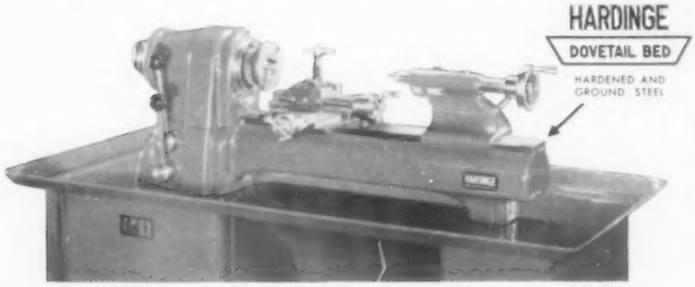


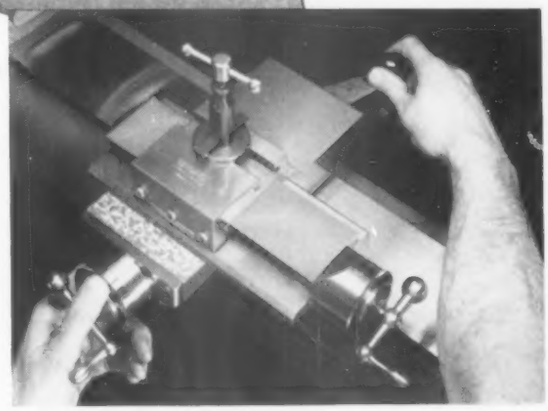
Rapid and Accurate Positioning with HARDINGE Compound Slide Rest

This compound slide rest obsoletes all other compound slide rests due to speed and accuracy of operation. It can be applied or removed from the HARDINGE Dovetail Bed in five seconds or less, making it the fastest positioning compound slide rest known. Also, when removed from the dovetail bed and reapplied, it will repeat previous index slide settings in relation to the spindle centerline. This cannot be said for ordinary compound slide rests.

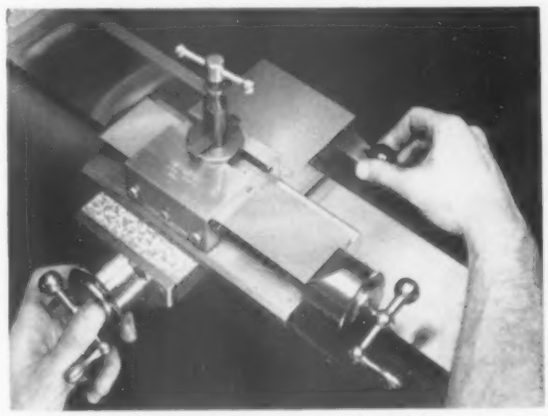
OTHER FEATURES: Hardened and ground steel index slide section; large hardened feed screws mounted on preloaded ball bearings; easy-to-read 2″ diameter feed screw dials; index slide swivels 360° and has two independent locks; solid bottom slide does not have a weakening T-slot for conventional bed bolts.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.





In the unlocked position, the quick-acting lock is released, permitting the Hardinge Compound Slide Rest to be moved along the bed ways or lifted from the machine.



The Hardinge Compound Slide Rest is rapidly and accurately locked in any desired position on the bed ways by a simple 90° movement of the lever.

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* CHAPTER MEETING NIGHT

THE BETTER PLUG GAGE

STANDARD

DuBo* Gage

SINGLE END
Sizes 1.510" to 6.010" (38 to 152 mm)

DOUBLE END
Sizes .240" to 1.510" (6 to 38 mm)

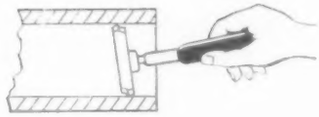
Gaging Surfaces are portions of a sphere

Gaging Surface

LIGHT IN WEIGHT

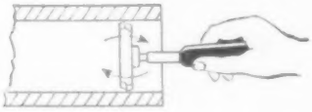
DuBo Gages over 1" diameter weigh 70% to 80% less than corresponding AGD cylindrical plug gages. Their lightness gives greater ease in handling, resulting in less strain on the operator, fewer errors due to fatigue.

EASY TO ENTER



DuBo requires no jockeying to enter, even into undersize bores. Inserted with the handle tipped slightly above the bore axis, it enters easily, more easily than even a piloted cylindrical plug gage. This means time saved.

DEFINITE CHECK



The check is made by lowering the handle gently, bringing gaging surfaces in contact with bore walls. Whether or not handle will drop freely below bore axis is the definite, yes-or-no answer even if part is close to limit.

DuBo Gages can detect out-of-roundness and taper whether enlarging toward or away from the opening!

*Patents Pending

IT ALL ADDS UP TO PRODUCT IMPROVEMENT *along with* COST SAVING

Write for Bulletin

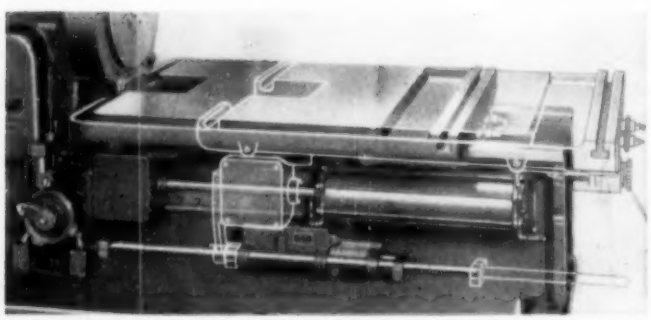
STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

CHATTER-FREE!

. . . FOR HEAVY, FAST PRODUCTION

SIMPLIMATIC TOOLING

is supported by solid metal from the floor up!



THE SIMPLIMATIC PLATEN TABLE rests on and against hardened and ground steel ways and gibs. It has a fast, smooth traverse to and from cutting position, actuated by pneumatic cylinders.

VERTICAL HEAD TOOLING can be arranged instead of on horizontal platen table when desired. Here, too, you have maximum rigidity and solid support for tools right to the cutting edge.

The heavy platen table of the Simplimatic automatically locks after it traverses to cutting position. Thus it and all the tooling on it become virtually one piece with the bed.

Because of the freedom in positioning slides on the big platen table, tools can be held close to their cutting edges and favored in any way desired. Moreover, this freedom from chatter is permanent because slide top is mounted on hardened steel ways and gibs.

Combined with the solidity of the cutting tools is the precision-fitted spindle of large diameter, on widely spaced roller bearings and its large herringbone drive gear mounted close to the nose. There's no chance anywhere for vibration. Chatter is *designed out!*

That's why Simplimatics can hold to extremely close tolerances, on large parts and at high production speeds. Ask for complete information about the Simplimatics.

Look Ahead . . . Keep Ahead . . . with Gisholt

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GISHOLT MACHINE COMPANY
1257 E. Washington Avenue, Madison 3, Wisconsin

YOU CAN RENT A CAMEL FOR 50c

In China and Nigeria men are still consciously employed as pack animals. A coolie will carry 10 gallons of oil for ten miles in a day for 10 cents. In Nigeria the porters portage for 18c a day. Camels work better and cheaper. You can charter a cactus burning ship of the desert for 50 cents a day. It will carry 250 pounds 15 miles per diem for a tarrif of 13 cents per ton mile.

You are happy that inventive men are bringing your winter's coal at 1c a ton mile. But are you devising ways to save manpower or camelpower in your own plant? Until you make or ask someone else to make a fresh appraisal of the possibilty of building a special tool for each of your most costly operations you may be unconsciously using men for pack animals. Why not consult Vulcan?

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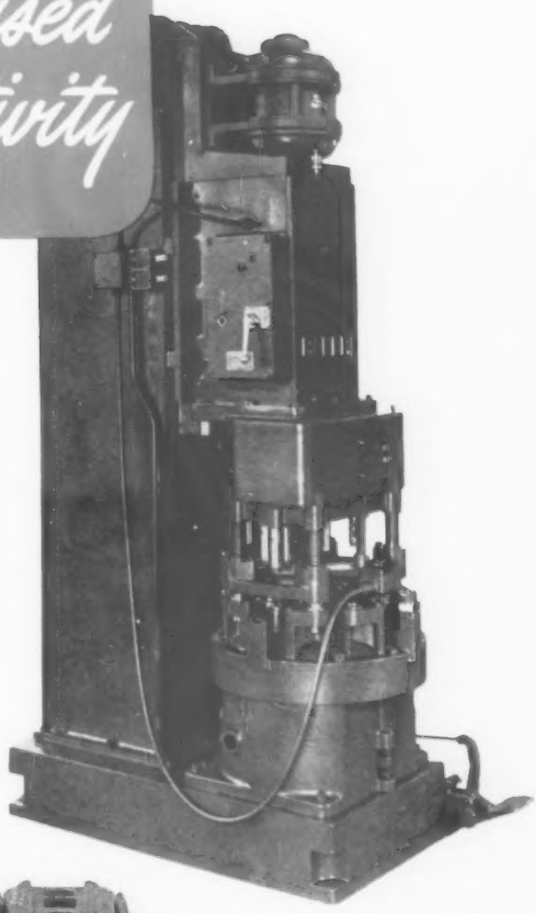
BAKER ... KEY TO Increased Productivity

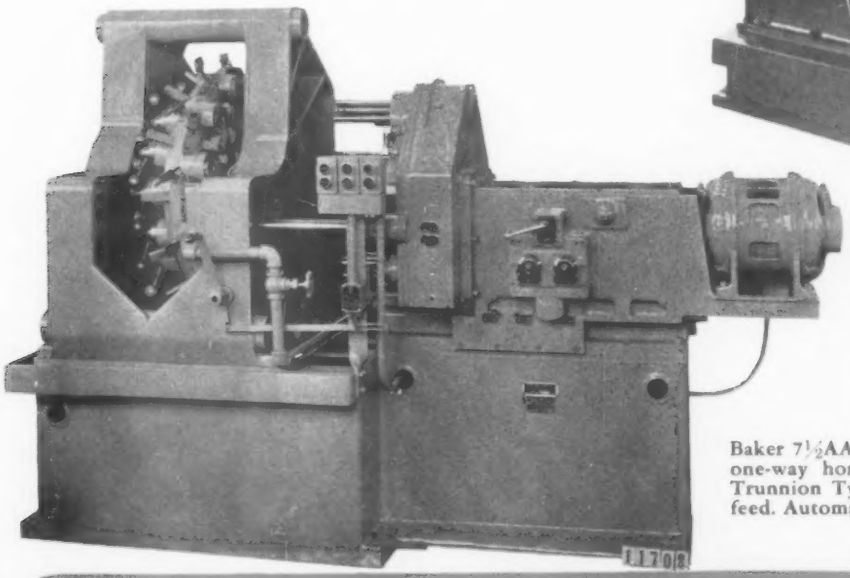
A recent survey of industry shows that *new methods* and *new machines* are highly important factors today in obtaining *increased productivity.*

This is particularly true among users of Baker Machines —because every Baker is designed to make it easier for the operator to produce *more* in *less* time with *less* effort!

By combining operations and reducing work-handling, Baker Machines offer the right set-up for greater production and improved accuracy. Baker units are highly flexible... can be adapted to a wide range of operations including single or multiple spindle drilling, boring, reaming, counterboring, hollow milling and chamfering. Send us details about your job-problem. We'll be glad to show you how a Baker Machine will help you beat rising costs with an upswing in productivity!



Baker 5A12 self-contained hydraulic feed unit mounted on vertical column having a 12-spindle fixed center multiple head arranged to drill, ream and countersink screw and dowel holes in a cam shaft gear. Has 4-station hand indexing table.



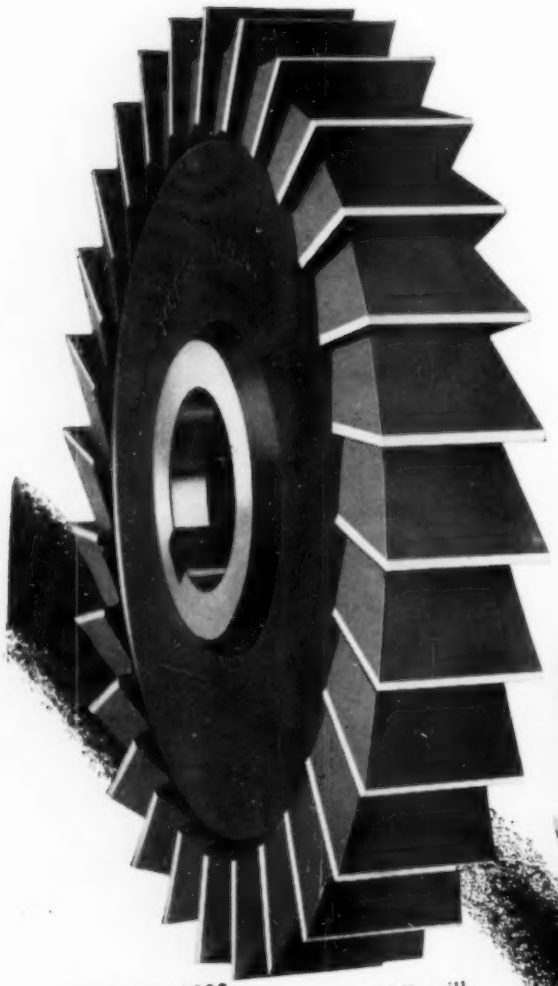
Baker 7½AA-14 Unit as applied to one-way horizontal machine with Trunnion Type Fixture. Hydraulic feed. Automatic cycled.

BAKER BROTHERS-Inc. TOLEDO OHIO

DRILLING - BORING - TAPPING AND KEYSEATING MACHINES

MORSE

that



MORSE No. 1833.
Side Milling Cutter—For general straddle milling, slotting, and side milling.

MORSE No. 1809.
Alternate Tooth Side Milling Cutter—For deep slotting, keyway, and heavy-duty milling. Teeth of alternate right and left hand spiral provide shearing action and eliminate side thrust. Cutting action is smooth and rapid.

MORSE No. 1830.
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MORSE No. 1802.
Heavy-Duty Plain Milling Cutter—Ideal for heavy cuts where considerable stock is to be removed.

Makes the Cutters

Make the Most of Time

Morse Milling Cutters are designed to make the most of time by giving *maximum* performance on each job. The result of over 80 years of experience, Morse Cutters are noted for their *consistently long life, smoothness of cut,* and *high return per sharpening.*

Milling Cutters of all kinds are available from Morse. Besides those shown, Morse can supply you with Angle, Convex and Concave Cutters, Woodruff Keyseat and Involute Gear Cutters, as well as any of the other high quality cutting tools in the complete Morse line—End Mills, Reamers, Taps, Dies, and Drills.

Maximum Cutter performance depends upon many factors and only when *all* these are known can the proper Cutter be selected. You can derive the benefit of our experience by letting Morse help you in the selection of the proper Cutter for *your* job. Your Industrial Supply Distributor will cooperate in securing a Morse recommendation.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manu

MORSE TWIST DRILL & MACHINE COMPANY

The Original Manufacturer of Twist Drills

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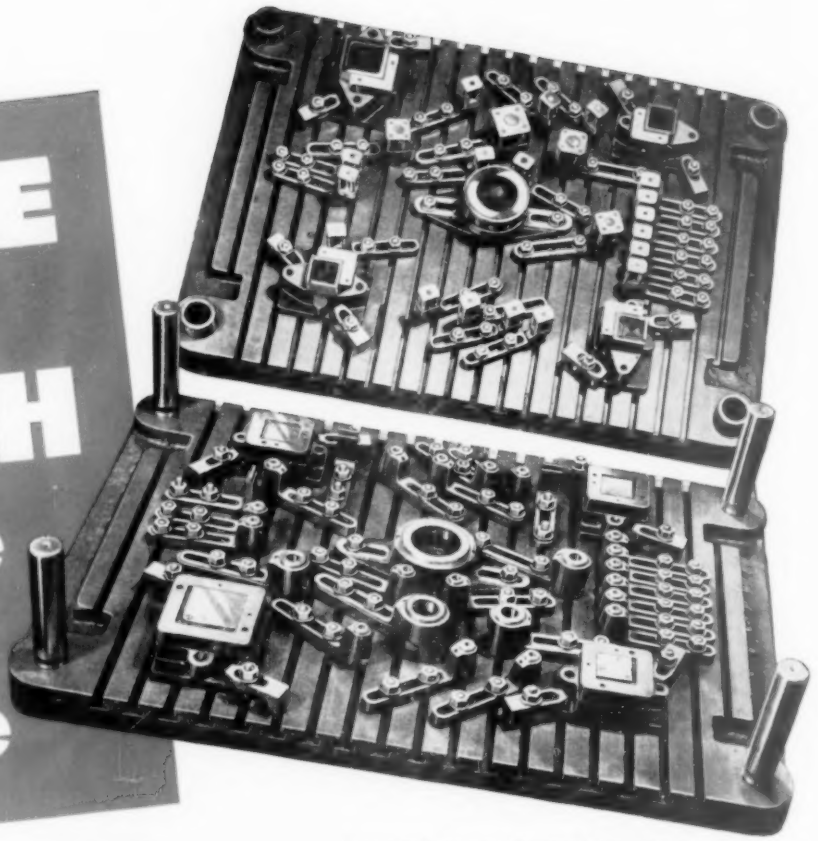
PIERCE and NOTCH at the same time

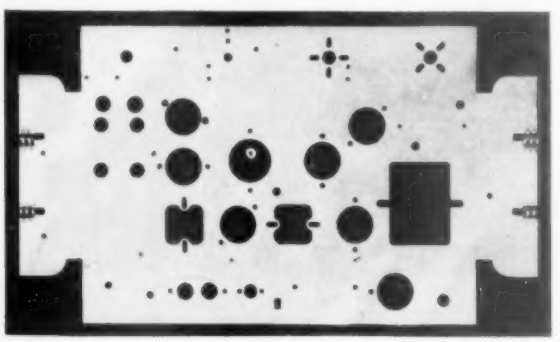


A typical set-up for notching and piercing.

with

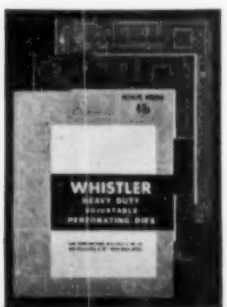
WHISTLER

MULTI-USE Adjustable Dies



Pierced and notched with Whistler multi-use adjustable dies.

You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.



Whistler multi-use adjustable dies are available from stock... a day or two from your plant ...in all standard sizes from 1/32" to 3" diameters... round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for... you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production... cut *your* costs. Write today for the Whistler Catalogs.

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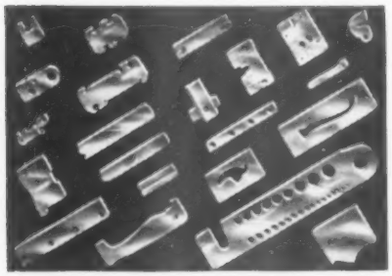

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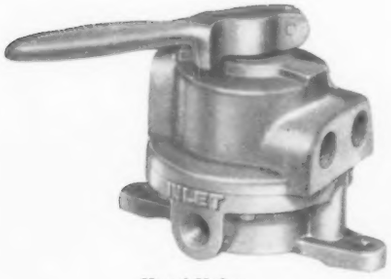

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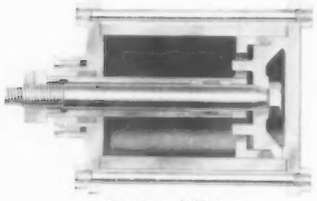
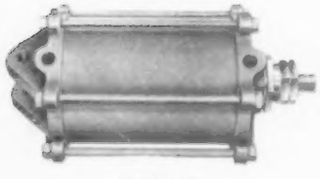
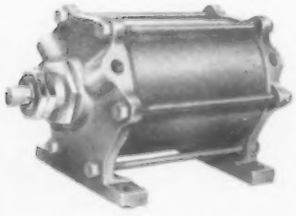


Sectional View



Model BR



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Editorial

« Let's Look at the Record »

A SITUATION CONFRONTS US in this country, today, which is fraught with danger. The danger is that, under the stress of reconversion, the average man may ignore realities and be duped into thinking that it is to his advantage to trade a heritage for a dubious mess of pottage.

Taking advantage of temporary dislocations in our economy, certain individuals vociferously claim that the American way of life is a passing phase; that democracy and capitalistic production may have been all right in their time but are no longer adequate. These individuals offer us a panacea; they would have us substitute communism for Americanism and, presto!—everything will be "hunky dory"!

These zealots utterly ignore not only the past record of our American way of life, but the industrial and agricultural role of the United States in the recent war. By creating dissension, and tense and hysterical situations, this small minority has become a disruptive force hindering the tremendous production potential of American industry.

Fortunately, engineers as a group are a rather prosaic lot. They are not easily swayed by bombast or excited talk, nor are they prone to wishful thinking. Rather, theirs is a cold, matter of fact way of analyzing and weighing unusual problems and situations. Therefore, let's look at the record.

The American way of life has yielded the highest standard of living in the world, bar none. Glittering generalities, flung promiscuously about, that America can be saved only if it adopts a system of government and an economy foreign and antithetical to its history become shabby and fraudulent when viewed in connection with a nation which has adopted communism as its way of life.

This totalitarian state cannot even begin to compare to the United States in consumer goods. The average subject of such a system cannot boast an automobile, a radio, an electric refrigerator. This applies not only to luxuries but even to necessities. It is significant that the majority of our recent foreign visitors are anxious to purchase suits, shoes, soaps, and the ordinary commodities.

The American diet is far more adequate, and our housing shortage in the cities pales into insignificance compared to the grave need in totalitarian cities. These conditions existed under such systems before the war and can be considered as only aggravated by the hardships undergone during the war. Basically, despite tremendous sources of raw material and a tremendous manpower, these systems of planned economy have not lived up to predictions.

A comparison of prewar production figures reveals that the famous "five-year plans" of Soviet Russia do not even touch American production. The claim that the percentage of increase in production in Soviet Russia has exceeded any other country may seem valid until it is realized that 50 per cent of two is only one, while ten per cent of 100 is ten.

But aside from legerdemain with percentage figures, the real discrepancy between production in other countries and in the United States is one of low per capita production in the former, and the highest per capita production of the world, in the latter. American production, per worker per hour, exceeds that of any other country. American capital investment in machinery per worker exceeds that of any other country. In mechanization, under free capitalist enterprise, lies the real reason for our tremendous production.

In America, the human factor in production is considered in terms of industrial relations and human relations. Men—that is, sheer manpower alone—are not substituted for machines in industry. The individual needs and the idiosyncrasies of the people as a whole are given every consideration in this country. We are not governed by centralized dictates which may transplant entire communities to Arctic islands or concentration camps for not participating in the economy as outlined by the government.

Thus, when the two economies and political systems are compared, the United States emerges with the higher per capita, as well as total productivity, and with a democratic freedom for the individual. The higher per capita productivity of the American worker results in a higher return, to him, in real wages and, consequently, a greater share in the results of his labor. The freedom of thought, freedom of speech, freedom of the press is so integral a part of our lives that, in keeping with our beliefs, we permit those who would deprive us of these to speak their views.

Our job as engineers, as Americans, or as just plain John Q. Citizens, is to bring the truth to every man, woman, and child, by using plain facts and plain figures. Americanism, the American way of life, needs no hysterical passion as its defense. The facts speak for themselves. We have only to make the facts available in our press, radio, books, magazines, and schools. Our truth will prevail.

Am Largent

President 1946-47

By Georg Schlesinger

Machinability of Metals

In Which the Author Reduces the Problems Of Metal Cutting to a Common Denominator

FOR FIFTY YEARS or more, the cutting of metals by turning, milling, planing, drilling and shaping—yes, even by sawing—has created problems that have intrigued the interest of the keenest minds among tool and production engineers and research workers in metal processing laboratories. Nor have these problems, as yet, been reduced to a common denominator since, with each introduction of new metals or alloys for cutting, or of new techniques in metal cutting, there have been created new problems that, in turn, have had to be reduced to workable formulas.

The aim here, however, is to strike an average from the enormous variety of possibilities, and to derive therefrom practical and therefore generally applicable rules that will be readily understandable to production executives and foremen, as well as to operators—who may be termed active performers—and inspectors, the latter considered as trustees of good workmanship.

Georg Schlesinger **was graduated from the Berlin-Charlottenburg Technical University in 1896 and, in 1903, received a Doctor's Degree from the University of Berlin. In the interim, he had been employed as junior designer at Ludw. Loewe, leading German machine tool builder, where he was later promoted to Ass't Works Director and Chief Designer.**

Engaged as professor at University of Berlin, from 1904 to 1934, he taught production engineering, administration and factory management; also, served as Director of Production Research.

Moving to Belgium in '34, because of racial persecution in Germany, he served as Associate Professor at Brussels University. Then, in '39, he removed to England, where he became creator and Director of Department for Production Research for the British Industries at Loughborough, serving in that capacity until 1944. He is now retired and resident in the United States. Dr. Schlesinger is author of 29 books and articles on machine tools, testing, rehabilitation of maimed soldiers, accident prevention, cost accounting and kindred subjects related to production.

In this connection, considerable credit is due Mr. J. F. Allen, of Warner & Swasey Company, Cleveland*, for a summary of variables involved in metal cutting. His research program contains:

Combinations of Cutter Shape	12000
Combinations of Speed, Feed, and Depth of Cut	18
Grades of Carbide to be used	12
Combinations of Cutter Treatment	8
Kinds of Material to be cut	8
Total Combinations involved:	
12,000 x 18 x 12 x 8 x 8 = ...	165,888,000

*"*Exploring Carbide Possibilities in Single Point Turning," by J. F. Allen in September, 1946,* The Tool Engineer.

Using v_{60} as cutting speed for one hour tool life, working only 40 hours per week and 50 weeks per year the achievement of the total would require 165,888,000/(40 x 50) = 82,940 years; thus enabling a perfect organization of well directed collaborators—say ten—to finish the job in about 8,294 years.

Therefore it is quite clear—and I am sure Mr. Allen will agree—that the theoretical total of 165,888,000 tests must be considerably condensed to provide a useful minimum. In other words, a voluminous problem must be reduced to manageable figures directly applicable to workshop use.

A Property of Material Only

Machinability is a property of material only. It is the one variable which we must know and use, unequivocally and independent of any type and shape of tool, in the same manner that the designer uses tensile strength of materials, as a single quantity, separated from all other physical and chemical properties of ferrous and non-ferrous materials.

Machinability may be defined as the behavior of a material whilst being cut with a standard cross section of chip using a standardized kind and shape of tool. Therefore, machinability depends on the resistance which the correctly shaped cutting edge of the tool meets in penetrating a given material.

Machinability of materials must not be confused with *life of tools*, which characterizes the tool with reference to the properties of various materials which tend to dull the sharp cutting edges by: (1) Its resistance to machining; (2) the destructive friction of the severed chip sliding over the upper surface of the hard tool or gouging its sides—i.e., cratering, and (3) the abrasive action of the material (e.g., of pure soft copper).

The *machinability-index* of a material remains the same, whether it be cut by carbon steel, High Speed Steel, Super High Speed Steel, Stellite or Cemented Carbide, or whether it be of small or large diameter.

Tool life, however, is the length of time that a tool will cut efficiently without regrinding**. Tool life depends upon the material to be cut, the material and the shape of the tool, cutting speed, cross section of chip, and the coolant. The measuring unit is time in minutes, hours, or number of shifts before regrinding. (A) Machinability and (B) tool life, then are the fundaments of production and affect the efficiency of large and small shops alike.

Machining, by removing material from ferrous, non-ferrous and non-metallic materials, covers the great majority of workshop processes such as turning, planing, drilling, boring, reaming, milling, thread cutting, gear cutting and grinding, and machine tools must be strong enough to supply the power—in hp or kilowatts—required by the cutting force and cutting speed and to produce a good surface without vibration marks.

The relation of cutting speed (v feet/min.) to tool life (t min.) is $v \times t^n = C$, in which C is a constant depending on the working conditions and equal the cutting speed for a total life of minutes; v = the cutting speed in feet per

**"*Life Tests of Single Tools made of materials other than Sintered Carbides*" (ASA B5-1946).

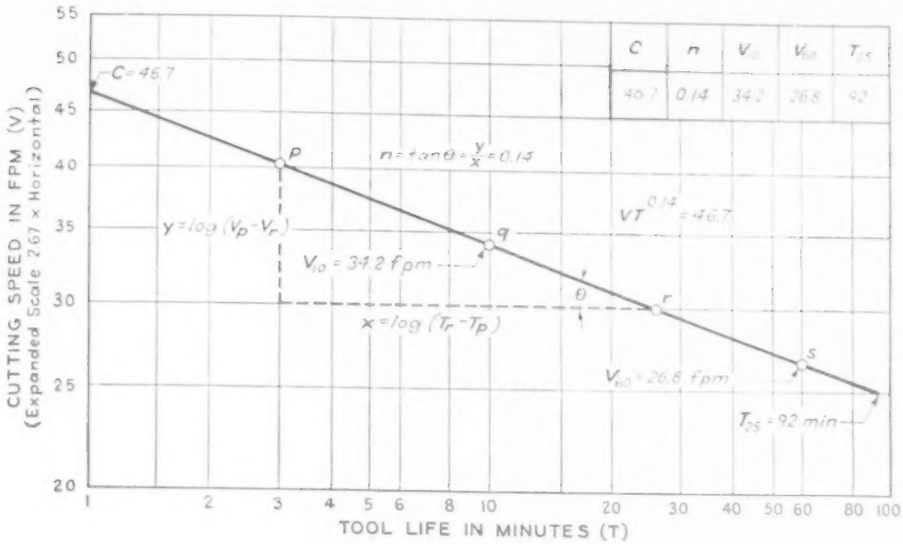


FIG. 1. The cutting-speed tool-life line for turning with single-point tools, as determined from experimental tests as at p, q, r and s. (Proposed American Standard Association, ASA-B5.19-1946.)

minute; t = the tool life or duration of cut between grindings in minutes; and n = the slope of the straight line on log-log paper (cf. Fig. 1).

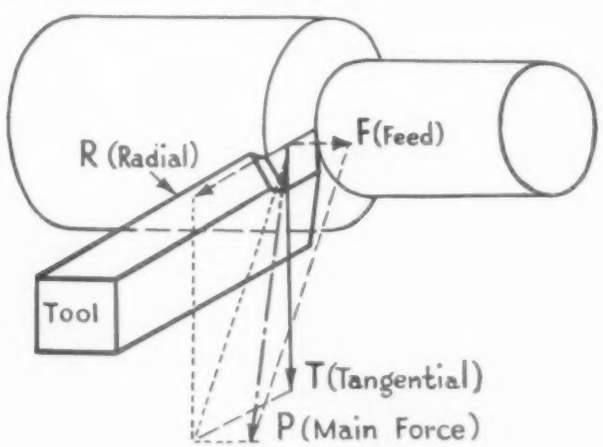
Turning action is continuous, either of short (2 to 5 minutes) or long (60 to 400 minutes) duration, and the chips are free flowing. Coolant of any kind, and in any quantity, may be applied. Turning permits the use of a single point tool the shape of which is easiest to be produced, the cutting speed remaining constant along the cutting edge.

Drilling Test More Difficult

Compared with these clear-cut conditions, the drilling test, which is sometimes used, presents great difficulties. Even with good twist drill grinders, the two lips of a twist drill or of a flat drill can never be duplicated so exactly that both will produce equal chips, compared to a single point turning tool. There is, for instance, the chisel point that is not cutting and, in addition to other factors—that is, in test purposes—the simultaneous work of the two cutting edges depends on the good working conditions of the drilling machine. Also, the tool is rotating, and penetrating deeper and deeper; therefore, the chip removal and the coolant supply to the cutting edge present additional problems.

It is still more difficult to obtain ideal test conditions for milling and grinding, using tools with multiple cutting edges and interrupted cutting action. However, all these processes

FIG. 2. Main force and its three components.



have been investigated during the past several decades by the leading production research men in the United States, Great Britain and the Continent, with the interesting result that the turning operation has been singled out as the representative test process.

It may therefore be considered safe to transfer the machinability results from the turning process to drilling, boring, reaming, lapping, milling and gear cutting.

This is an inclusive statement, essential to the case, and puts the handling of machining processes on a common basis; although, because of its infinite cutting edges, the grinding process covers a specialized if well-known field and may therefore be considered as an exception to the rule.

Machining may represent only a small part of the manufacturing costs, with materials and overhead amounting to as much as 85 to 92% of these costs as, e.g., in the case of motor cars and agricultural machinery. However, the small remainder of 8 to 15 per cent for labor by machining is the deciding factor for profitable production. By its immediate influence on tool life and machine capacity (hp), therefore, machinability for materials, is the most important problem of the planning and rate-fixing department when determining the cutting time of workpieces.

For functional purposes, physical properties such as tensile strength, yield point, elongation, Brinell hardness, impact and fatigue strength, and the chemical analysis such as the percentage of carbon, chromium, manganese, nickel, molybdenum, tungsten, sulphur, and phosporous, are bases for specification to the purchasing department. These are carefully checked, by laboratory tests, by both supplier and user alike. The addition of a machinability-index, as established in a short cutting test of about 5 minutes, would complete the material specification and guarantee the desired machining properties—a very important item.

It is the writer's opinion, based on investigations of over 40 years, that machinability is only loosely connected to such properties as tensile strength, Brinell hardness and other properties, and that machinability co-efficients should be established by a short *cutting* test, with the usual tool, on an ordinary lathe.

Instruments Determine Values

The well-known three-component dynamometers, equipped with hydraulic, electrical or mechanical measuring gauges, deliver useful values for the three components of the main cutting force P (Fig. 2), viz., tangential force T, radial force R, and feed force F. These gages are typical laboratory instruments requiring a well trained staff of operators, as well as careful and repeated calibration. They are sensitive to careless use, expensive to buy and run, and even in their smallest design require such overhang in front of the toolpost and centre height as to make their use prohibitive for routine workshop test on existing machine tools.

If, like the hardness test, the machinability test is to become a workshop test, it must fulfill the following conditions: (1) The apparatus must be simple, rugged, inexpensive, easy to calibrate and applicable to machine tools available in every workshop. (2) The test must require only one operator with average engineering training. (3) The test must give reliable results on the raw material itself in a minimum of time—say 5 minutes from floor to floor—with

a minimum of material wastage. (4) The test must give direct reading results, without calculations, and must be instantly visible to a number of observers simultaneously. (5) The test must be reproducible anywhere under identical conditions.

When tackling the job of finding machinability of materials, these must be grouped into at least eight classes following the proposal of Mr. Allen; but, in close connection with standardized shapes of tools, the usefulness of which have been proven by innumerable tests checked in the most modern workshops making motor cars, airplanes, machine tools, combustion engines, electromotors, tools, gages and instruments of all kinds.

Table I shows a well proved table of such standardized tool shapes coordinated to classified materials—e.g., used to cover more than 150 different kinds of ferrous and nonferrous materials. The quantity of necessary materials varies between 30 and about 200, depending upon the kind and size of manufacturing plant using them. For example, machine tool works may need 30, ship yards 150; however, the tendency should be to reduce the various kinds in use to the permissible minimum.

Using standardized tools, the specific pressures of the cutting action of 14 typical materials (cf. Fig. 3 and Table II), were investigated by the writer over an interval of more than twenty years. This investigation covered different cross sectional areas of chips and the 3-components, T, R, F, of the main cutting force (Fig. 2) which were measured, in lbs., by a 3-component dynamometer with hydraulic gages on a heavy special lathe.

It is not possible to measure the oblique main force (P) directly; however, this is not necessary because only the three components (T, R, F) are essential for the design of a machine tool. The fact that the tangential component (T) only is necessary to determine the machinability-index of any material simplifies the whole cutting program enor-

TABLE I. Standardized tool types allocated to ordinary materials.

α and β, σ and η are to be checked by template gage. SHAPES → ANGLES →		γ	Θ	α	α	κ	λ	σ	R	δ_1-δ_2-δ_3
Mat. No.	$\alpha+\beta+\gamma=90°$									
2	6 + 80 + 4 = 90°									
3	6 + 76 + 8 = 90°									
4	6 + 72 + 12 = 90°									
5, 8	6 + 69 + 15 = 90°									
6, 7	6 + 59 + 25 = 90°									
Mat. No.	$\sigma+\eta+\Theta=90°$									
3, 4	6 + 80 + 4 = 90°									
5	6 + 76 + 10 = 90°									
6, 8	6 + 69 + 15 = 90°									
7	6 + 59 + 25 = 90°									
2	6 + 84 + 0 = 90°									
No.	Class of Material to be Machined	Side Rake Degrees	Side (top) Rake Degrees	Side Clearance Degrees	Front Clearance Degrees	Plan Approach Degrees	Plan Trail Degrees	Nose Clearance Degrees	Nose Radius Inches	Secondary Clearance Degrees
1.	Chilled iron; very brittle brass and bronze	0	0	6	3	10	10	3	.080	2 to 3°
2.	Steel and steel castings of more than 45 tons tensile; hard casting and malleable iron of more than 200 Brinell; hard brass and bronze	4	0	6	6	10	10	6	.040	2 to 3°
3.	Steel and steel castings of 30 to 45 tons tensile; cast iron of less than 200 Brinell; ordinary brass and bronze; stainless steel	8	4	6	6	10	10	6	.030	2 to 3°
4.	Steel of 20 to 30 tons tensile; soft cast iron	12	4	6	6	10	10	6	.030	2 to 3°
5.	Soft bronze; hard aluminum-alloys	15	10	6	6	10	10	6	.015	2 to 3°
6.	Soft aluminum-alloys	25	15	6	6	10	10	6	.015	2 to 3°
7.	Soft copper	25	25	6	6	10	10	6	.015	2 to 3°
8.	Elektron	15	15	6	6	10	10	6	.015	2 to 3°

mously and facilitates its practical solution. The workshop executive would find it hopeless to tackle a problem with about 165,000,000 combinations!

In graphs (Fig. 3) the tangential forces (T) are plotted for the cross sectional areas shown at right.

These took in 14 materials, No. 1 through 5, soft to hard steels; 6 to 7, alloy steels; 8 and 9, cast iron and steel castings; 10 and 11, copper alloys; 12 and 13, aluminum alloys; and 14, magnesium alloy (Elektron).

The graphs were straight lines in the log-log system, sloping from the small cross section of 0.00039 sq. in. (0.25 mm²) as maximum forces per unit to the big cross section of 0.078 sq. in. (50 mm²) as minimum forces. The specific pressure decreases when the cross section of chip increases. In some cases, however, they are parallel to the horizontal axis, as, for example, for a certain kind of very uniform normalized steel with the machinability-index 242 lbs. per 0.001 sq. in. (cf. Table III).

sq. in.	mm²
.00039	.25
.00078	.50
[.0010] *	.645
.0015	[1.0] *
.0031	2.0
.0062	4.0
.0093	6.0
.0155	10.0
.0310	20.0
.0620	40.0
.0780	50.0

**The boxed cross sections should be standardized for both the inch and the metric system. The figure "1" simplifies the problem enormously.*

Chip Area

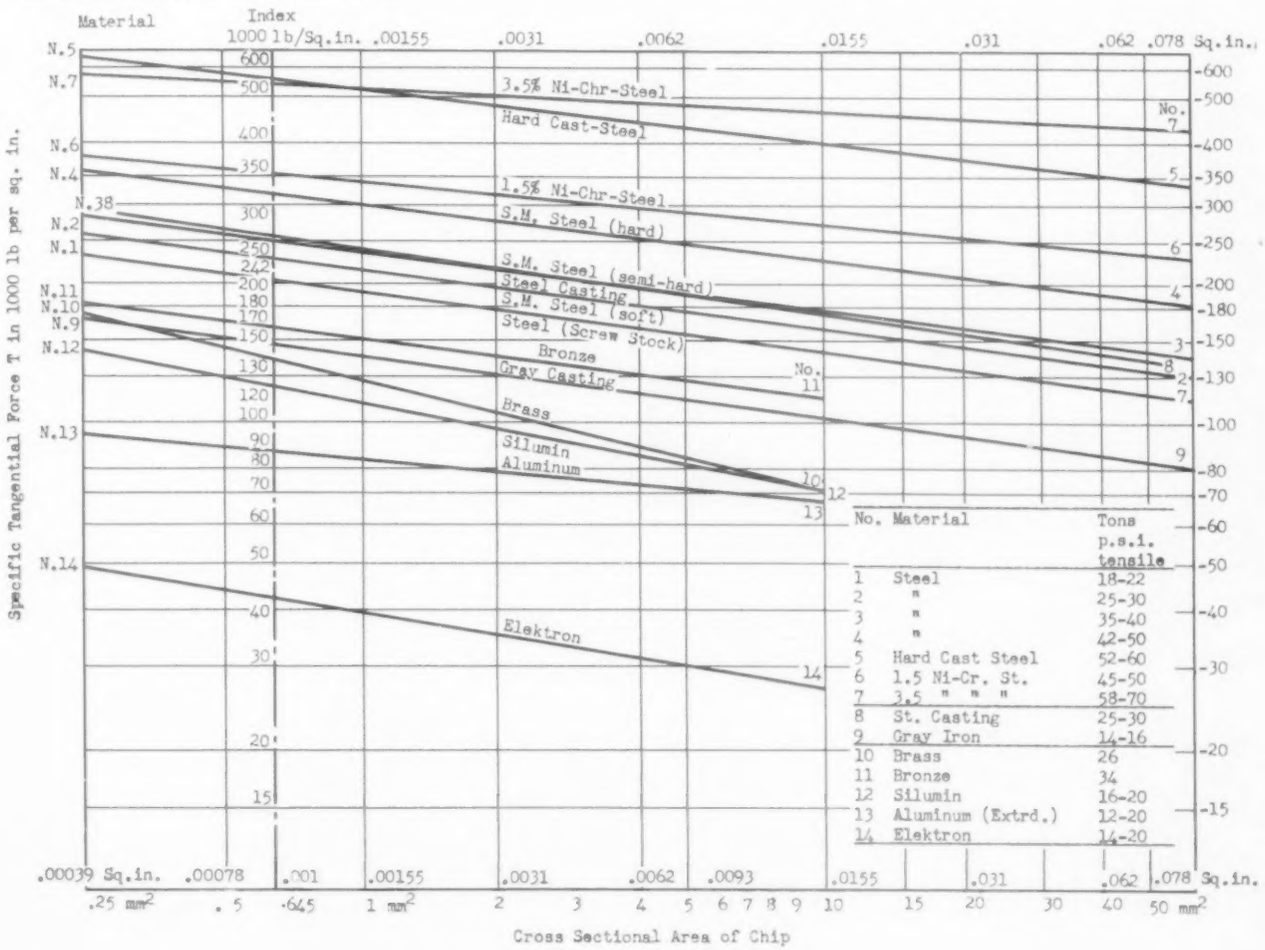
If we standardize the cross sectional area of the machinability tests to 0.001 sq. in., we have many advantages: (1) We eliminate three digits, e.g., reading 242 per 0.001 sq. in. instead of 242,000 per sq. in.; (2) we can use a small testing lathe of 2 to 3 hp, which is available in every workshop; and (3) we read as index-cipher: I = T/A, the direct value in pounds measured with a small one-component instrument (Fig. 4).

This dynamometer can be clamped in the tool post of an existing lathe or capstan (turret) lathe, having a square shank of not more than 1¼" x 1¼", a small projection of ¼" downward and a small overhang of 2½", corresponding to a very strong ordinary box-tool on the cross-slide. This allows for the big model of dynamometer to take chips up to 0.16" x 0.04" = 0.0064 sq. in., with a maximum tangential force of about 3500 lbs. (e.g., on 3.5% Chr-Ni Steel) without vibration of the very rigid dynamometer. The tangential force is read directly on the simple dial gauge (0.0001" per division). Therefore, the writer proposes to use 0.001 sq. in. as the international reference area for taking machinability tests.

Starting with the above suggestions for a standardized and reproducible machinability-index, the main reluctance in regard to workshop tests is based (as previously mentioned) upon the extraordinary quantity of variables, but which can now be reduced to 19 fundamentals as follows:

Materials resistance to cutting	No. of Variables
(3-components)	3
Abrasiveness (grade No.)	1
Cutting Conditions: Cutting speed	1
Chip area (depth x feed)	1
Ratio (depth : feed)	1
Coolant	1
Tool: material—as high speed steel, Stellite, cemented carbides, and so forth	1

FIG. 3. Interdependence of specific forces per material (Nos. 1 to 14); and cross sectional areas of chip (1000 lbs. psi) machinability-index = tangential force/sq. in. = 1 lb./.001 sq. in.



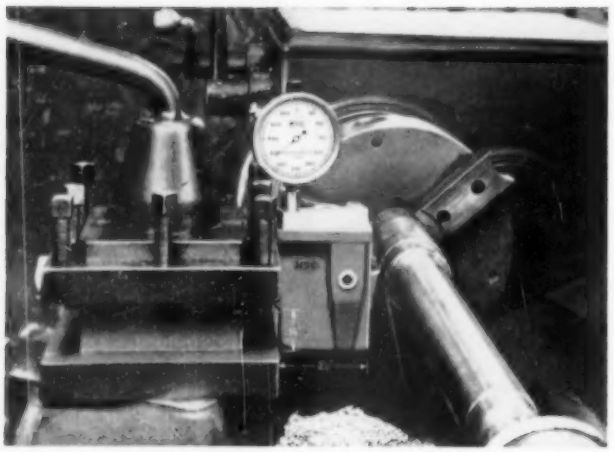


FIG. 4. Component Dynamometer, design by G. Schlesinger. Made by Machine Shop Equipment, Ltd., London.

Hardness	1
Tool angles	6
Nose radius and nose clearance angle	2
Tool sharpness	1
Total	19 VARIABLES

Following, it will be shown that, by a deliberate treatment, these 19 variables can be partly eliminated and partly standardized so that only the machinability-index emerges as one numerical factor.

The machinability-index has been defined as the resistance of a material measured by the tangential cutting force (T) per 0.001 sq. in., caused by a turning action.

For a given tool the radial force (R) and the feed force (F) form small fractions of the main force (P) and remain in constant proportion to the tangential force (T) (Fig. 5). Furthermore, as they are acting either perpendicular (F) to the plane of torque or within this plane (R) by the machine spindle, they do not consume any perceptible power if the friction in the thrust ball bearing can be disregarded. Thus, the tangential force T (power component) becomes the only force which we have to measure in our workshop with the one-component tester. Therefore, three variables are reduced to one.

Abrasiveness of a material shall be stated as its abrasion number, and this is just as constant a property of the material as the physical properties (tensile strength, hardness, and so forth) and the chemical analysis. The evaluation of this abrasion number will be dealt with later under tool life, but it does not change for the classes of ferrous and non-ferrous materials.

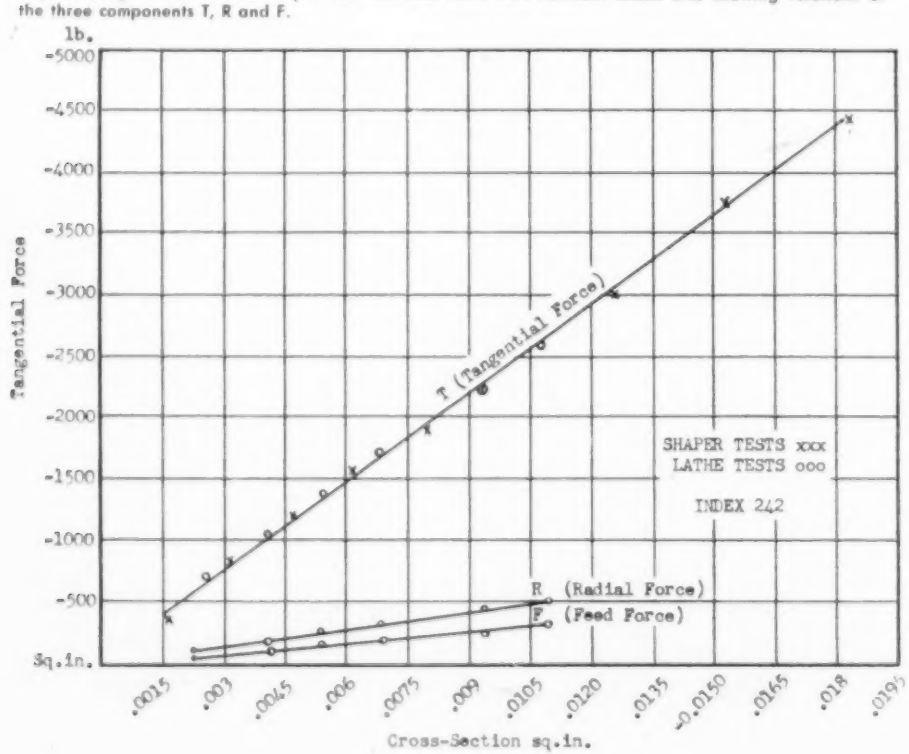
Cutting Conditions

(1) Cutting Speed: It is important to note that the cutting speed has no influence on the machinability-index, as the tangential force (T)—as criterion—remains constant for speed variations from 30 to 500 ft. per min. as used with high speed steels and even cemented carbides used in modern machine shops. This fact is proven by the graphs of Fig. 6, which are the results of a long series of tests made by the writer on mild steel (35-40 tons tensile) with chip areas of 0.00155 sq. in. (1 mm²) and 0.0062 sq. in. (4 mm²) and four kinds of Ni-Cr-steels (1.5% Ni; 2.5% Ni; 3, and 5% Ni) partly carburized, partly heat-treated alloys from 40-80 tons tensile with chip areas of 0.0093 sq. in. (6 mm²) and 0.0124 sq. in. (8 mm²).

The plotted tests prove that, for all these cutting speeds, the tangential forces remained constant, viz., 500 lbs. and 1700 lbs. for the two chip areas of mild steel, and from 700 to 4800 lbs. for the chip areas of four different kinds of Ni-Cr-steels.

It is not until the cutting speed for ferrous and non-ferrous metals reaches a very high value (about 1000 fpm or more) that the specific cutting forces will be reduced by the faster speed. This was stated for the first time by the patent of Fr. Krupp and C. Salomon nearly 20 years ago, a fact later confirmed by H. Ernst, Cincinnati, as a result of his thorough investigations of the necessity for increased cutting speeds for the effective use of negative rake angles for milling cutters.

FIG. 5. Graph of lathe and shaper tests on mild steel with constant index 242 showing relations of the three components T, R and F.



(2 and 3) Chip Area and Ratio: The introduction of 0.001 sq. in. as standard with depth to feed = 4 : 1 would eliminate two variables and also facilitate the comparison of the machinability-index in the metric system (= 1 mm² = 0.00155 sq. in.) since the difference of the index values of the two cross-sections is negligible for this purpose (cf. Fig. 3).

The proposed small cross-section of 0.001 sq. in., then, gives the maximum value of the machinability-index, and is a very good basis of comparison in itself. A further important point to be considered is that the proposed small cross-section and the resultant small tangential force make it possible to carry out the machinability tests with as little as 2-3 hp power consumption—that is, with machines available in practically every workshop. The ratio, depth to feed, should be not less than 4:1 to 5:1—e.g., 0.063" depth x 0.016" feed (= 0.001 sq. in.). Chips of such small area can be taken

No.	Material	Tensile Strength Tons psi	Brinell Hardness	Machinability Rating Index-Cipher related to .001 sq. in. Tolerance ± 10%	Recommended Cutting Speeds for v_{60} fpm		
					HS Steel (18-4-1)	Super HSS (Co 10 to 12% + 18-5-1.5)	Cemented Carbides
1	Steel (Screwstock)	18-22	80-100	205	60-80	100-120	400-600
2	Steel	25-30	120-140	230	40-60	60-90	250-400
3	Steel (Semi-hard)	35-40	150-180	250	35-55	50-80	220-325
4	Steel (Hard)	42-50	180-220	320	35-50	45-70	175-250
5	Steel (Cast Steel)	52-60	230-270	520	25-45	35-60	150-200
6	1.5 Ni-Cr Steel	45-55	200-230	350	35-50	50-70	175-250
7	3.5 Ni-Cr Steel	58-70	250-310	510	20-35	30-50	125-200
8	Steel Casting	25-30	135-160	252	35-60	70-90	150-300
9	Gray Casting	14-16	170-190	145	40-60	85-100	180-350
10	Brass	26	115	138	100-140	150-200	400-800
11	Bronze	34	140	162	70-100	100-150	300-550
12	Silumin	16-20	70-90	122	100-140	150-200	500-800
13	Aluminum (Extr)	12-20	30-70	87	150-225	250-300	800-1000
14	Elektron	14-20	40-60	42	200-300	300-400	1200-2000
MACHINABILITY: Material, Hardness Number, Tensile Strength, Machinability-Rating (Index) for 14 Materials based on Tangential Force (T) per 0.001 sq. in.					TOOL LIFE: Usual Cutting Speeds v_{60} for different Types of Tools.		

TABLE II. Constant factors of machinability versus varying cutting speeds for 60 minutes tool life (v_{60}) and three different kinds of tool materials.

from material from 1" dia. upward, reducing the test bar by ⅛ in. dia. only for each test since the results of speed, by reduction of diameter, are irrelevant.

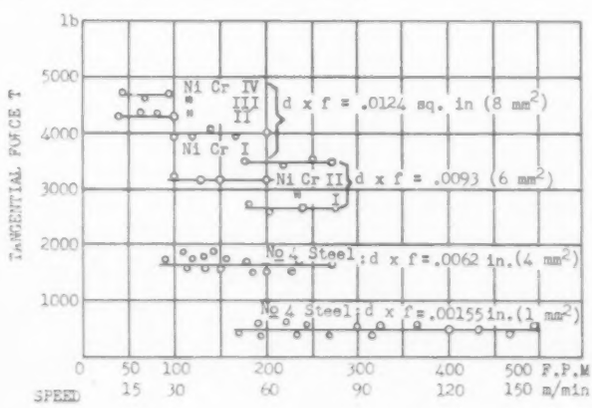
The machinability-index remains the same for all diameters—a natural result. Machinability of a certain material cannot be affected by its size or by the type of tool. A turning length of 1" to 2" will be sufficient to give a good average reading in 2 to 5 minutes. According to the experience of the writer, the maximum differences on the same material were 5%, which is very little, with regard to the natural lack of uniformity in long bars.

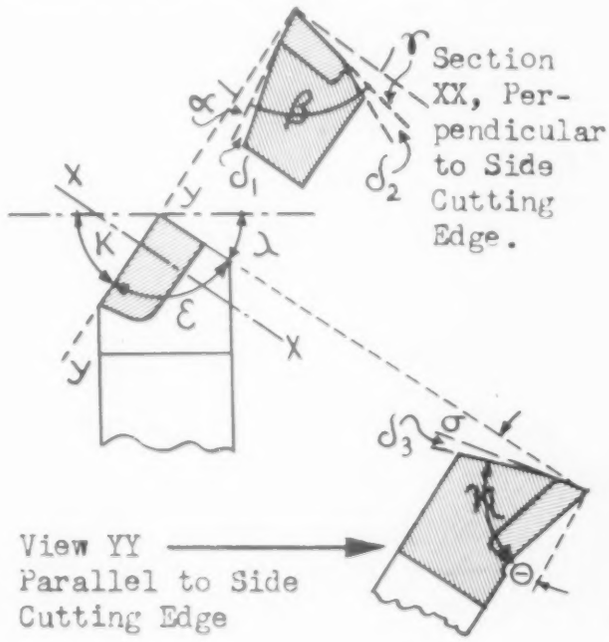
(4) Coolant: High speed tools require an ample use of coolants for rough-turning, drilling and milling ferrous metals. Any composition of a good soluble oil—dilution 1 : 15—should be adopted to determine the index. (Non-ferrous metals may be turned dry.) Then, this cutting condition of coolant is again standardized and known by its influence. As the cutting speed is irrelevant (cf. Fig. 6) and the chip area is completely standardized to 0.001 sq. in. by 0.063" deep x 0.016" feed, the four variables of the cutting conditions have become test standards and disappear as variables.

The most complicated element in these investigations is the tool (Fig. 7). We must know its material: whether made of carbon steel, of high speed steel (18 - 4 - 1), of super high speed steel (18 - 5 - 1.5 + 10% to 12% Co), of Stellite, of cemented carbide or of diamond. Dependent on the material of the tool is its hardness which, in turn, depends on the heat treatment of HS and SHS steels, or the grade of Stellite or carbides, and which should be checked after hardening (high speed steels) by a Vickers or Rockwell diamond tester. In the case of high speed steel it should be about 62 to 65 Rockwell "C." The hardness of carbides is, of course, as supplied by the maker and unalterable between Rockwell "C" 82 and "C" 90.

FIG. 6, below, cutting speed without influence to tangential force within the usual limits.

FIG. 7, right, nomenclatures for shape of tool: α = side clearance angle; β = side included angle; γ = side rake; θ = back (or top) rake; σ = front clearance (nose relief) angle; η = back included angle; κ = plan approach angle; ε = plan included angle; λ = plan trail angle; R = radius of nose angles; δ_1, δ_2, δ_3, = auxiliary clearance angles of soft shank toward hard tool tip.





Furthermore, we must know the shape of the testing tool given by seven independent angles and the nose radius: side rake (γ), back rake (θ), side clearance (a), back clearance (σ), plan angle of approach (κ), plan trail angle (λ), not counting the secondary angles (δ_1 δ_2 and δ_3).

As the shape of the tool is dependent on the variety of tool materials which may be used in any shop, the first step is to group the whole range of possible materials into groups of identical tool shapes and to standardize the later (cf. Table I).

It is important to note that only the side rake (γ) and the back rake (θ) angles, and the nose radius (R) are of real importance. All clearance angles (a, σ) and the angles of plan approach and trail (κ, λ) are of secondary importance, and do not influence the machinability test and may be kept constant for all materials—the only exception being tool No. 1 of Table I applied to brittle and very hard materials rarely used, when $\sigma = 3°$ instead of 6°. The nose radius should be R = 0.030" for tools Nos. 2 to 4; and R = 0.015" for tools Nos. 5-8, for non-ferrous metals.

It will be readily understood that, for the machinability tests, the standardized cutting tool is of the same relative importance as the steel ball of 10 mm diameter is to the Brinell test, or the shape of the diamond indenter (136°) for the Vickers hardness test. If any of the relevant tool dimensions are changed, as by hand grinding, or measuring by uncontrolled angle protractor reading, the basis of comparison is upset and the test results with such a tool become incorrect and unreliable.

A suitably designed set of simple grinding fixtures, with one setting for each of the eight combined rake angles (γ and θ), would make it a simple matter to maintain the correctness of the eight calibrating tools as proposed. The jigs (gages) can be used by semi-skilled male or female labor in the toolroom whenever the tools become dulled through long use. Then, the jigs would guarantee the shape of the tool and later checking should not be necessary.

Preferably, angles should not be checked with an adjustable angle protractor; only a rigid template gage containing all rake and clearance angles should be used. (Fig. 8.) Lastly, the sharpness of the tool is to be considered. Generally it is checked by sight and touch after final honing with a diamond impregnated wheel or lap.

However, a more reliable check test should be made on a reference bar of known and uniform machinability-index—viz., bright mild steel, 20-30 tons psi. If the machinability-index of the reference bar remains the same before and after the series of tests, the operator will know that his tool

TABLE III. Cutting tests on: (1) Lathe; and (2) shaper on the same material, with constant machinability-index for all sections of chips.

1	2	3	4	5	6	7	8	9
Test No.	f = const't feed, in.	d = depth of cut		A = area of chip, inches	v = cutting speed, fpm	T = tangent force, lbs.*	I = index 1000 lbs. psi	Input to motor, kw
1	.035	.076		.0027	72	660	241	1.90
2	.035	.076		.0027	61	645	240	1.65
3	.035	.114		.0040	82	1002	249	2.89
4	.035	.117		.0041	73	1002	242	2.64
5	.035	.158		.0056	85	1380	244	3.69
6	.035	.168		.0059	64	1470	250	3.00
7	.035	.189		.0066	72	1580	240	4.13
8	.035	.267		.0093	74	2250	235	5.57
9	.035	.265		.0092	66	2250	238	4.93
10	.035	.307		.0107	65	2520	237	5.5
							242 ± 3% Av.	

Upper part, test on lathe; lower part, test on crank shaper. Material in both cases steel 30 to 35 tons psi tensile strength. *All forces were measured with a "Schiess" three-component dynomometer.

1	2	3	4	5	6	7	8	9
Test No.	No. of strokes per min.	L Length of stroke, in.	dxf = Depth x feed in inches	A = Area of chip, sq. inches	v = (mean) cutting speed, fpm	T = Tangent force, lbs.*	I = Index 1000 lbs. psi	Input to motor, kw
1	12	21.65	idle		35			2.67
2	12	21.65	.04 x .04	.00155	35	373	238	3.64
3	12	21.65	.08 x .04	.0031	35	755	242	4.18
4	12	21.65	.12 x .04	.0047	35	1145	244	5.26
5	12	21.65	.158 x .04	.0062	35	1540	245	5.74
6	12	21.65	.158 x .05	.00775	35	1880	239	7.28
7	12	21.65	.158 x .06	.0093	35	2250	238	8.43
8	12	21.65	.158 x .08	.0124	35	3020	242	9.63
9	12	21.65	.195 x .08	.0155	35	3770	241	11.27
10	12	21.65	.235 x .08	.0186	35	4480	238	13.22
							241 ± 2% Av.	

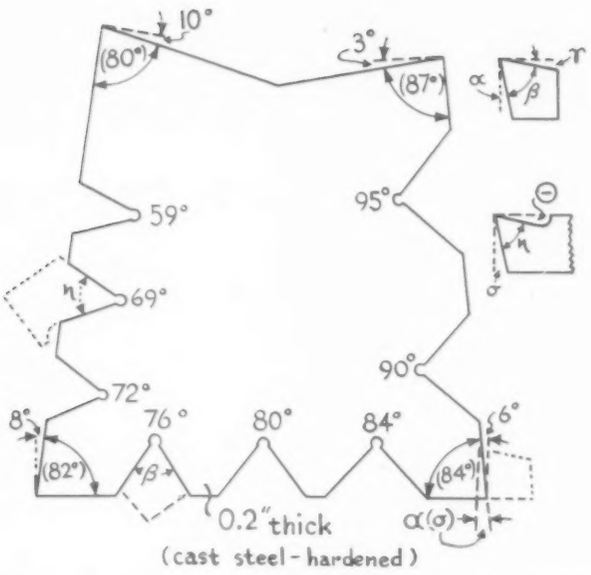


FIG. 8. Rigid template gage to check reground tools. Gage contains all angles of Table I (cf. Fig. 7); also contains all angles by using the complementary angles:

β = side included angle, α = side clearance angle } γ

σ = front clearance angle, η = back included angle } θ

remained sharp during all his tests. One 1" length of ½" dia. bar, for example, is sufficient to re-hone the calibration-tool occasionally; and only when chipped or damaged by some accident must the tool be re-ground completely. In such case, its sharpness will have to be checked on the reference material as a routine test—as this is done, for instance, with the Vickers or Rockwell tester.

Thus, with the standardization of the cutting tool, a further 11 variables are eliminated and the seemingly most difficult question of securing the correct tool is now easily solved. It also becomes clear, from these considerations, that the material to be machined and the standardized tool shape are linked up together; however, the proposed system allows the isolation of the one variable, *machinability material* (T), as the very object of investigation.

The one-component *machinability tester* (cf. Fig. 4) measures the tangential force (T) as only variable in direct readings as machinability-index. The tester is, as above mentioned, intended for use in two sizes: (a) As a small one for measuring the machinability-index by tangential forces from 0.5 lbs. to 600 lbs. using 0.001 sq. in. as standardized check area. (b) As a large one for measuring tool life and tangential forces from 100 lbs. to 3500 lbs., using chip areas from 0.001 sq. in. to 0.0155 sq. in., (about 1 mm^2 to 10 mm^2) for heavier cuts. However, the problem of machinability would be completely solved by accepting the proposed method using the small tester only, since it covers all machinability indices from soft Elektron to hard chrome nickel steel.

Tool Life

Now the question of tool life should be discussed. *Tool life* depends on the mutual influence of the same material on different kinds of tools with changing cross-sectional areas of chips. Therefore, tool life is more difficult to measure than machinability, as it takes much more time and material and power to exhaust a tool. It is, therefore, quite a different problem.

Tool life depends, as above mentioned, upon: (1) Material of piece to be cut; (2) material of the tool; (3) standard shape of tool related to the material turned; (4) hardness of the tool; (5) sharpness of the tool; (6) the cutting speed; (7) the chip area; (8) the coolant (dry included); and (9) quality of surface required.

Of these nine items the first five have already been discussed with the exception of abrasiveness pertaining to the specific material. Item 9 does not concern roughing tests as long as the tools remain sharp, which, again, can be checked by watching the indicator of the machinability tester. When the instrument shows a rise of 10%, slowly increasing, the tool edge is becoming blunt and a bright ribbon on the surface of the test piece indicates its failure soon after the permanent rise.

It is true that first, the nose, and then the side cutting edge are blunted, increasing the radial force (R) and the feed force (F) (Schlesinger criteron*). But very soon the tangential force (T) follows—summarizing the blunting effect of all three components to the cutting edges of the whole tool.

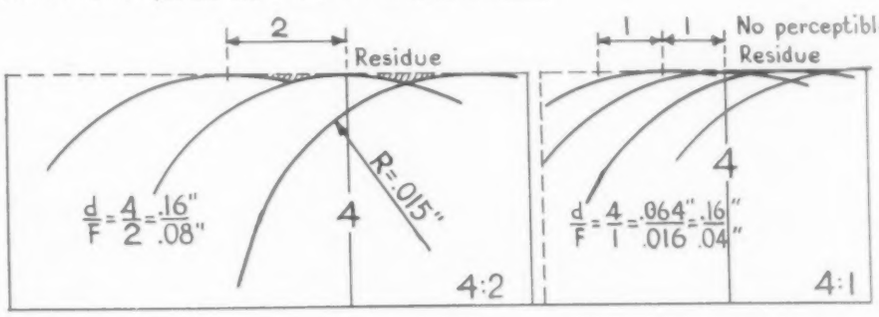
Item 8—the influence of the coolant—can be measured separately but may be standardized by selecting a suitable soluble oil and its dilution (1 : 15). Thus, only speed (item 6) and chip area (item 7) remain as decisive elements. Table II compares the constant factors of machinability with the varying factors of tool life.

From the foregoing it will be apparent that materials with the same machinability-index, and physical properties, and under identical cutting conditions (viz., tool material, shape and cutting speed) can be compared for abrasiveness. For instance, pure copper, which cuts very freely and has a low machinability-index, has an extraordinary dulling effect on the cutting edge. Its abrasion number would be No. 3 compared with No. 1 for steel of 35 to 40 tons tensile—i.e., the tool life is reduced in the ratio 1:3. Furthermore, certain stainless steels—12% manganese steel, 1.5% to 2% chrome steels (ball bearings)—have a similar dulling effect with abrasive numbers between No. 1.5 to 3.

The formula $v \times t^n = C$, of the A.S.A. (above mentioned) refers to the speed and the time; and the constant C includes the chip area. A larger area causes more heat and abrasive friction; both speed and chip area shorten the cutting time—i.e., the tool life.

As stated above, cross sectional area of chip is determined by depth and feed. For life tests the feed should be small and the ratio depth to feed d/f should be at least 4 : 1 to avoid an inadmissible residue (Fig. 9). The residue is negligible for ratios of 4 to 1 and larger depth; but not, e.g., for ratios 4 to 2 and larger feed. Thus, if cubic in./min. shall be used as the unit of comparison for tool life, the calculation $d \times f \times v \times 12$ = cubic in. (v in feet per minute) is only correct if negligible residue is ascertained by the correct choice of the dimensions of the chip area.

FIG. 9. Ratio of depth and feed at least 4 : 1 on behalf of residue.



*Kronenberg, "Zerspanungslehre" ("Science of Machinability"); Julius Springer, Berlin, 1927.

Type of Steel, No.	Speed, v fpm	Area of Chip, sq. in.	Vol'me of Chip, cu. in./ min.	Tangent Force T lbs.	Specific Pressure, lbs./ sq. in.	Power, hp	Type of Tool
4	175	.00155	3.26	465	300,000	3.55	Cemented
4	175	.0062	13.1	1550	250,000	11.8	Carbide
4	175	.0155	32.8	3500	185,000	26.6	"

The big model of the one-component machinability tester is so rigidly built that a cutting force of 3500 lbs.—corresponding to the tangential force of a chip section of 0.01 sq. in. (= 0.2" x 0.05" or 6 mm²) on 3.5% Ni-Chr steel—can be maintained for 60 minutes (called v_{60}), which varies with the material of the tool used for the same material (Table II). If a longer life than 60 minutes is desired—e.g., four hours—the cutting speed must be reduced to allow v_{240}, and still more for a whole shift (8 hours = 8 x 50 minutes) to v_{400}. The tool life curves, which plot the relation between speed per minute and tool life in minutes, are hyperbolas in the orthogonal system and straight lines in the bilogarithmic system.

Machine Tool

In the preceding sections all elements of power consumption have been discussed. We can always measure, with the machinability tester, the tangential force (T) (power component) which covers about 95% of the power drive. The influence of the radial (R) and the feed component (F), as caused by one of the eight standardized tool shapes, is negligible for the power drive, (cf. Fig. 5) and we can settle the economic cutting speed of high speed steels for the workshop as between v_{60} and v_{400}.

The motor (hp), the tangential force (T) and the cutting speed (v) are connected for the lathe by the following formula: hp = (T x v) / (33000 x η), where T is measured in pounds and v in feet per minute, η = efficiency factor. It will be accurate enough, for this purpose, to introduce $\eta = 0.7$ as the average efficiency factor of a useful ordinary lathe two to five years old. Then, 0.7 x 33000 = 23000 very nearly and hp = (T x v) /23000.

We are, therefore, able to select the most suitable machine tool in the plant for the task in question. The chip area which governs the tangential force depends upon the material allowance. Graph (Fig. 3) gives, for the different chip-sections, between 0.0004 and 0.078 sq. in. corresponding specific pressures if the machinability-index for 0.001 sq. in. is known by measurement with the workshop dynamometer.

When a workpiece is to be finished by one roughing cut and one finishing cut, the permissible data for both the roughing cut and for the finishing cut are known. Although the machine doing the roughing is always rugged enough for the finishing cuts, it may not be fast enough, nor sufficiently free from vibrations, to produce a good finish, and it may therefore be necessary to transfer the work to a less powerful but faster and more rigid machine. If the machining allowance for roughing is too great for this machine, there are only two possible alternatives:

(1) To take two medium roughing cuts adequate to the horsepower of the selected machine; or (2) to reduce the machining allowance by more suitable piece preparation (stampings, forgings, bright bars, and so on).

The graph (Fig. 5) and (Table III) show the relation between power consumption and chip area for an approximately constant cutting speed on the same material:

(1) For a lathe from 1.9 to 5.5 kw; (2) for a crank shaper from 2.67 to 13.2 kw, all values were found by measurement (reading instruments). Again, the tangential force which was measured here, together with the radial and feed component by a three-component dynamometer, are the keys to the solution, and the blunting time for the tool is the criterion for the economical cutting speed.

Some few examples may illustrate the foregoing statements for a lathe. For steel No. 4 (Table II and Fig. 3), of 42 to 50 tons psi tensile strength, the section of 0.0062 sq. in. (4 mm²) requires by measurement a specific pressure, not machinability-index which is determined for .001 sq. in. only—say of about 250,000 lbs./sq. in. With a cutting speed of v = 70 fpm for an SHS tool, the necessary power is: hp = (250,000 x 0.0062 x 70) /23,000 = 4.7 hp. Then, 3.5 Ni-Cr-steel No. 7 (cf. Table II and Fig. 3) requires for the same chip area and cutting speed a specific pressure of 480,000 lbs. sq. in. and 9.2 hp.

The machinability tester did show for material No. 4, T_4 = 1550 lbs. = .0062 x 250,000; (T = A x I); for material No. 7, T_7 = 2970 lbs. = .0062 x 480,000.

Both values are in the range of the big instrument. For the constant speed of v = 175 fpm, using carbide tool and three variable cross-sectional chip areas, the power consumption—e.g., the size of lathe required for the job—would be (assuming the same efficiency factor) $\eta = 0.7$ (cf. graphs Fig. 3): The table would be as per the chart at the top of this page.

A lathe of 26.6 hp is already unusually large and the rate-fixer (time-study) has to consider if it would be preferable to choose an SHS tool with v = 70 fpm for which a machine of 10.6 hp would suffice. High speed steel requires considerable power, and demands, eventually, a reduction of the cross-sectional area of chip. This is the crucial decision if cemented carbide tipped tools and negative rake angles are to be used with success on existing machines.

With variable cutting speeds—e.g., v_1 = 200 fpm for a cemented carbide tool; v_2 = 90 fpm for Stellite-80; v_3 = 70 fpm for super high speed steel and v_4 = 40 fpm for ordinary high speed steel—the table would be as per the table below.

Steel, No.	v fpm	A, sq. in.	Vol'me, cu. in./ min.	Tang. Force (T), lbs.	Specific Pressure, lb./ sq. in.	hp	Tool
4	200	.00155	3.7	465	298,000	4.05	Carbide
4	90	.0062	6.7	1550	250,000	6.1	Stellite
4	70	.0155	13.2	3500	230,000	10.6	S.H.S.
4	40	.031	37.5	6320	215,000	11.0	H.S.

The tangential force of 6320 lbs. is too big even for the large size of this dynamometer. The danger is here that this large force would destroy the driving gears with the same motor of 10 hp if the rate-fixer would prescribe the HS tool and a large cross-section of 0.031 sq. in. (20 mm²), overlooking that then the cutting force is dangerously increased, while the speed is decreased.

The rate-fixer now has all the necessary data for his job: (1) Machinability (T) of the material; (2) cutting speed for the standardized tool (v); and (3) power consumption of the machine tool hp = (T x v) /C.

ACKNOWLEDGEMENTS:
(1) H. Klopstock, "Untersuchung der Dreharbeit" ("Investigation of the Turning Process"). Berich 8 des Versuchsfeldes fuer Werkzeugmaschinen, Charlottenburg, Berlin. Julius Springer, Berlin, 1926.
(2) G. Schlesinger, "Bearbeitbarkeit der Konstruktions-staehle im Automobilbau" ("Machinability of Construction Alloy Steels in the Motor Car Industry"). Stahl & Eisen, Duesseldorf, 1928, No. 10-11.
(3) O. W. Boston, "Tool Life Tests." Mech. Engineering (USA), Dec. 3, 1943.

The Editors, in turn, wish to gratefully acknowledge this contribution, "Machinability of Metals," written by one of the world's leading authorities on metal processing.

Roll Crushing Plus Diamond Dressing

Panto-Crush Wheel Dresser Speeds Form-Grinding and Reduces Costs

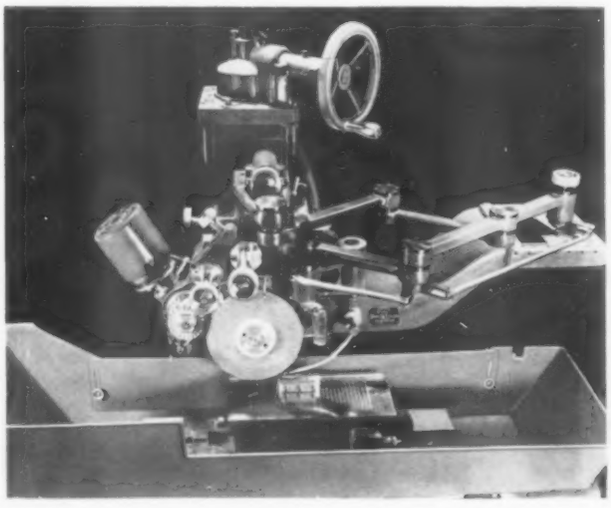
PANTOGRAPHIC DIAMOND form wheel dressing and roll crushing are now combined in a single machine, called the Moore Panto-Crush Wheel Dresser, developed by Moore Special Tool Company, Inc., 740 Union Ave., Bridgeport 7, Connecticut.

This dual-function wheel dresser consists of a high-precision pantograph, working directly from a template plus a power-driven roll crusher, both mounted together and accurately related to the spindle. This combination results in a precision and economy in form grinding, not achieved by either method alone or by both as independent units.

Either or both methods of wheel dressing may be quickly employed to suit the particular job. The operator may readily switch from one method to the other without disturbing the workpiece setting or the location of either truing device. It is not necessary to raise or lower the wheel spindle for dressing the wheel, yet the wheel spindle may be raised or lowered without losing the relation of the wheel form to the dressing device.

Once the template is made, the pantographic principle allows for repeated wheel dressings. No setup or removal of complex attachments is required for recurrent wheel dressing. The Moore pantograph principle also permits generating irregular curves and straight lines.

The recently developed Moore Panto-Crush Wheel Dresser which effectively combines roll-crushing and diamond dressing in a single high-precision machine.



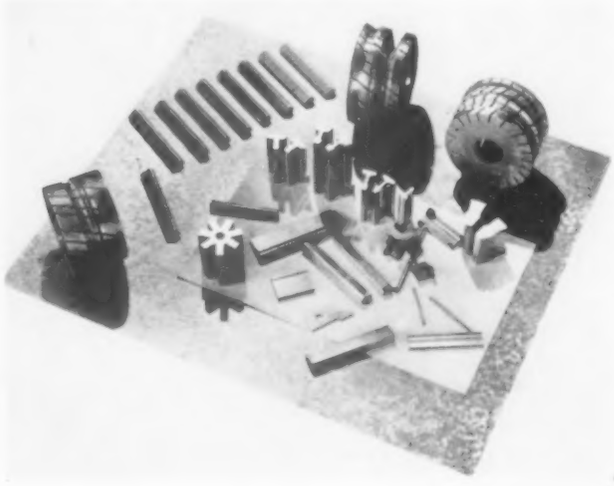
In addition to conventional pantograph movements, the stylus and diamond arms are capable of coordinated angular rotation. This permits the dressing of forms, otherwise difficult to dress, by changing angle of approach of the diamond to the wheel. Contours ⅞" wide may be formed without extending template beyond the table.

No expensive auxiliary machine is required to grind the crusher roll. The roll is ground in place, by the diamond dressed wheel, from the original template and used in the same spindle without disturbing the position. All pantograph pivots consist of pairs of super-precision pre-loaded ball bearings, set up to give rigidity consistent with sensitive response.

The power-driven crusher roll drives the wheel spindle by friction. This action produces true rolling, yet does not require any auxiliary slow-speed drive for the grinding spindle. The crusher roll may be re-ground as often as necessary to maintain true form, or whenever it is removed or replaced.

The crusher arm is mounted on a round bar, hardened, ground lapped and supported by line bushings similarly treated. Bar and crusher arm rotate for radial infeed into the wheel and slide for axial adjustments. The crusher is fed into the wheel by means of an eccentric cam, turned by hand.

A collection of form-ground tool parts and crusher rolls produced with this device, and assembled razor blade and lamination dies built up from ground sections.



By F. K. Fischer

Fundamentals of the Gas Turbine Power Plant

Place of Gas Turbine as Competitive Prime Mover Dependent Upon Continued Research and Development

COMPARING THREE TYPES of prime movers; steam turbines, internal combustion engines and gas turbines, the gas turbine is historically the oldest. However, in its useful development, it has found practical application. Today several forms of the gas turbine are being vigorously prosecuted for use in applications to which it is particularly well adapted.

The development of the gas turbine was held back due to the fact that engineers and designers, until very recently, lacked certain basic tools without which the gas turbine remains an inventor's dream. The difficulty has been in building a turbine that can develop more power than is consumed by its own compressor. Only at high temperatures, with an efficient turbine and an efficient compressor, can the gas turbine win by a comfortable margin.

To you readers, who are closely associated with the tool industry, the requirements of high temperature materials for the gas turbine is particularly significant. It gives you the difficult problem of finding ways and means of successfully manufacturing the extremely difficult-to-fabricate high temperature materials which the metallurgists have developed and are continuing to develop. The successful handling of this problem will play an important part in the continuing development and application of gas turbines.

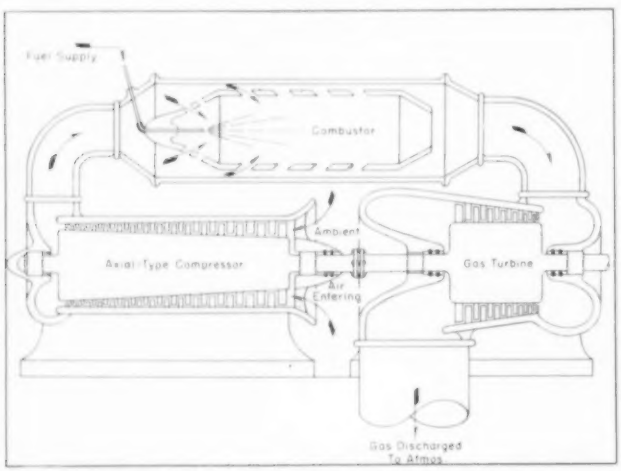
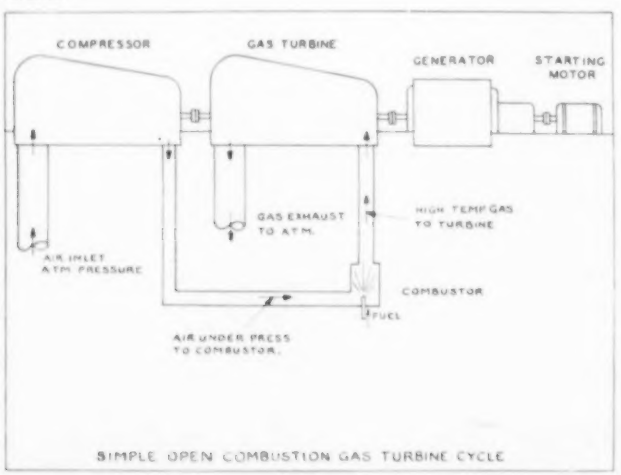


FIG. 1. Section through the three principle elements of the open cycle gas turbine.

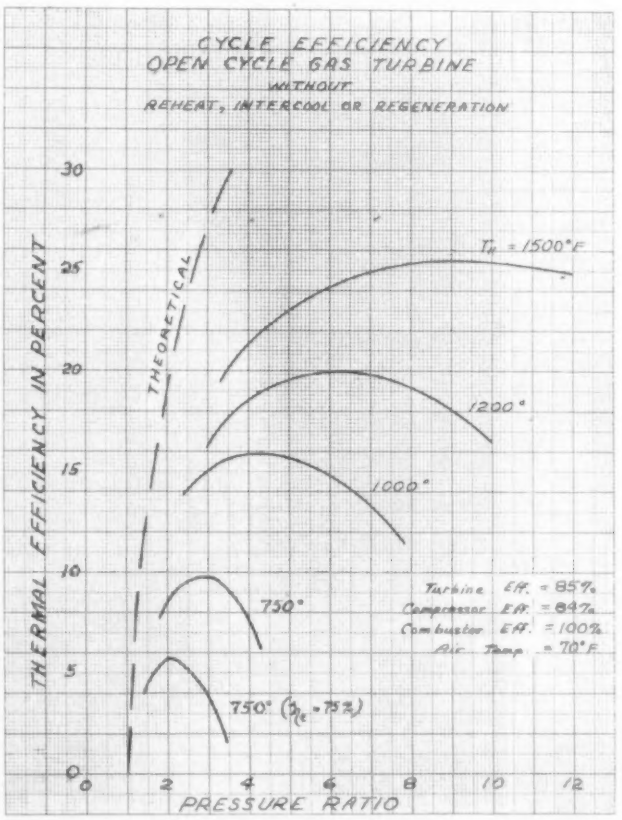
FIG. 2, right. Effect of temperature and pressure on the thermal efficiency of the open cycle gas turbine.

FIG. 3. Schematic arrangement of elements in simple open cycle gas turbine.



F. K. Fischer **was graduated from Rensselaer Polytechnic Institute in 1930, and received a Master's Degree from University of Pittsburgh in 1937. Following graduation from Rensselaer, he joined the Westinghouse Electric Corp'n as a student engineer, being successively assigned to circuit breaker engineering, research and development. Then, after several years as design engineer, he became Steam Application Engineer, assigned to the application of steam and related apparatus, a position he has held since 1940. He is a member of the A.S.M.E. and Sigma Xi.**

The gas turbine power unit, in its simplest form, consists of three major elements: an air compressor, a fuel combustor, and a turbine, with the generator or other driven apparatus connected to the shaft either directly or through reduction



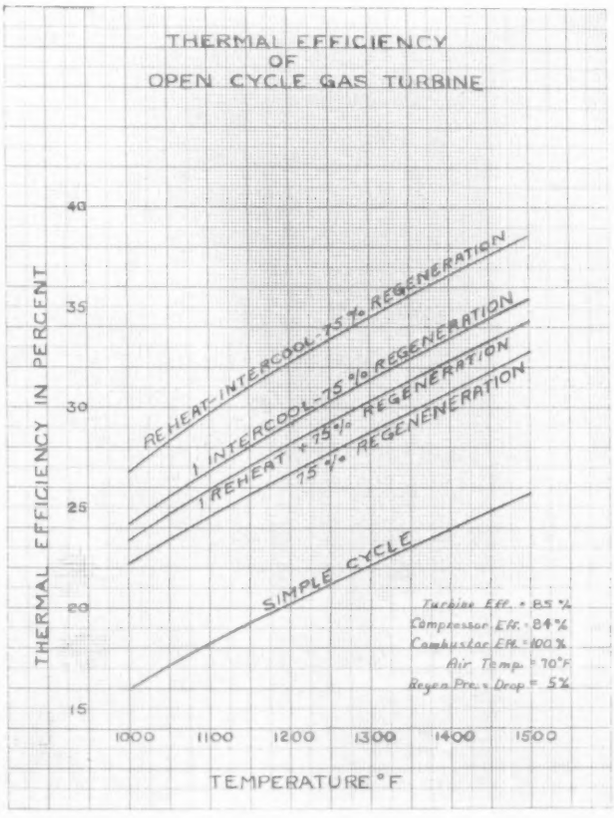
gearing. These elements are shown in relative size in Fig. 1 and schematically in Fig. 3. The compressor supplies air to the combustor at several atmospheres pressure (an atmosphere pressure, as you remember, represents approximately 15 lbs/sq. in.). In the combustor, fuel is burned at constant pressure, in direct contact with the air to form hot gases of combustion which expand through the gas turbine and exhaust at atmospheric pressure.

This arrangement is known as the simple open cycle. It is subject to considerable variation; on the average the turbine will develop approximately four units, of power; the compressor will consume three; and one power unit is available for delivery in useful form. The net power output being the difference between two such large values, it is obvious that the net efficiency is critically dependent upon sustained high level of both turbine and compressor efficiency. The compressor delivers several times the amount of air required for fuel combustion alone, so as to limit the inlet gas temperature to the turbine to practical limits for available materials.

In Fig. 2 the thermal efficiency of the simple open gas cycle is plotted against pressure ratio (pressure ratio is the ratio of compressor discharge pressure to the inlet pressure). For an open cycle a pressure ratio of six represents a maximum compressor discharge pressure of approximately 90 lbs/sq. in. absolute. A pressure ratio of ten represents a compressor discharge pressure of approximately 150 lbs/sq. in. absolute.

Maximum Efficiency at Low Pressure

From the curves, it is evident that maximum efficiency is obtained at a relatively low pressure level and that this pressure level can only be increased as the maximum temperature is increased. From this curve, Fig. 2, it is also evident that relatively high gas temperatures are necessary with the gas turbine cycle. Even with the relatively high element efficiencies used in this curve, the thermal efficiency at 1000 deg. F. is only 16%; and at 1200 deg. F. it is 20%, an increase in thermal efficiency of 25% for a 200°F. increase in gas temperature.



As the ratio of turbine inlet and exhaust pressure is low, the heat energy available for work per pound of gas flow is small and the flow of gas is large. A simple open cycle gas turbine operating at 1200 deg. F. and a pressure ratio of six (inlet pressure to turbine of approximately 90 lbs/sq. in. abs.) and having a net output of 5000 kw, requires a gas turbine having a gross output of approximately 20,000 kw, and a gas flow of approximately 500,000 lbs/hour.

The simple open gas turbine has many desirable qualities: 1. It is simple, consisting of three major elements. 2. The power plant is small and compact. 3. No cooling water is required and the unit can therefore be located without reference to a source of cooling water.

Its principle weaknesses are: 1. The large flows involved. 2. The efficiency is low unless very high temperatures are used.

There are three methods of markedly improving the open cycle efficiency without increasing its operating temperature. These methods each add complication to the cycle as illustrated in Fig. 4. By the addition of a *regenerator heat exchanger*, the efficiency can be increased materially. The regenerator merely transfers some of the heat in the hot exhaust gases leaving the turbine to the high pressure air leaving the compressor.

This interchange of heat reduces the amount of fuel burned in the combustor and therefore improves the cycle efficiency. The addition of the regenerator reduces the

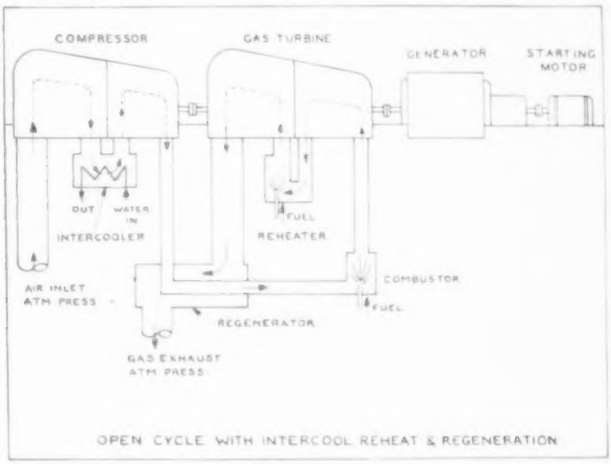
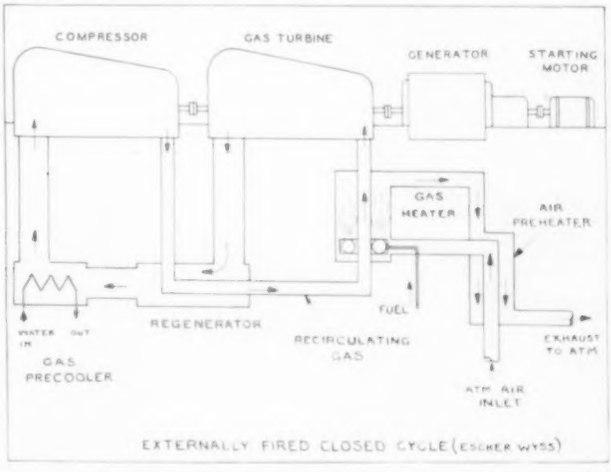


FIG. 4. Schematic arrangement of the open cycle gas turbine with regeneration, intercooling and reheat.

FIG. 5, left. The thermal efficiency of the simple open cycle gas turbine compared with the cycle using different combinations of reheating, intercooling and regeneration.

FIG. 6. Schematic arrangement of the closed cycle gas turbine system.



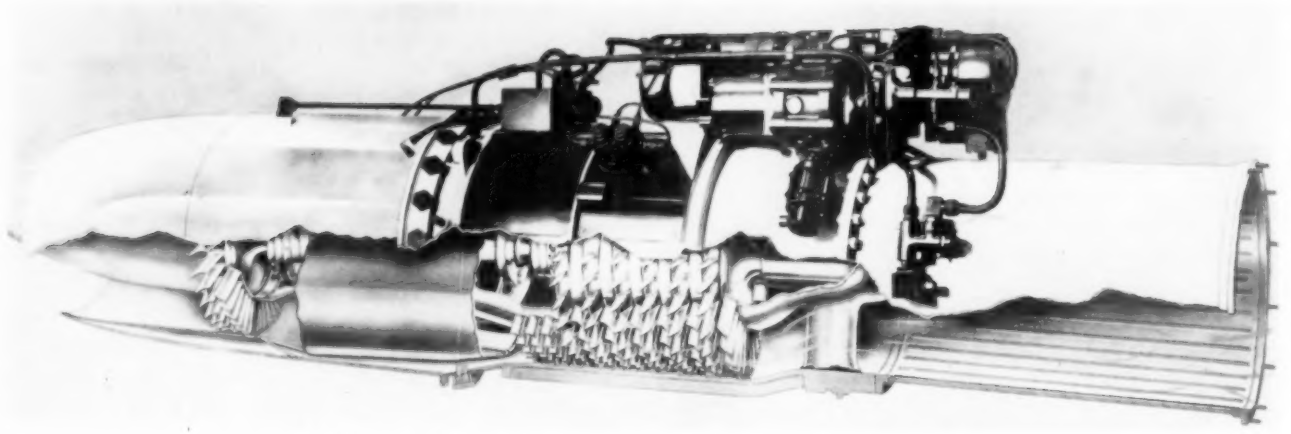


FIG. 7. Cutaway illustration of Westinghouse gas turbine jet propulsion aircraft engine.

pressure ratio at which the maximum thermal efficiency is obtained. That is, the optimum compressor discharge pressure, with the regenerator in the cycle, is considerably lower than with the simple open cycle. The size of the regenerator heat exchanger determines the amount of heat which is recovered. Obviously, the larger and more expensive the heat exchanger is, the more efficient the cycle becomes.

Intercooling Promotes Efficiency

A further gain in efficiency can be obtained by *intercooling the air in the compressor*. Intercooling accomplishes two things: (1) It removes part of the heat of compression imparted to the air in passing through the compressor; and (2) it increases the range of regeneration for the heat exchanger. In the intercooler, water is used to cool the air and reduce its volume. With other conditions remaining the same, one stage of intercooling will reduce the compressor work by approximately 15 per cent.

The second advantage of intercooling is due to the fact that the temperature of the air leaving the compressor is lower. As the air temperature leaving the compressor is lower, it can cool the exhaust gases from the turbine to a lower temperature and therefore can extract more heat from the exhaust gases before they are discharged to the atmosphere. The addition of the intercooler, in addition to making the cycle more complicated, means that a reliable source of cooling water is required.

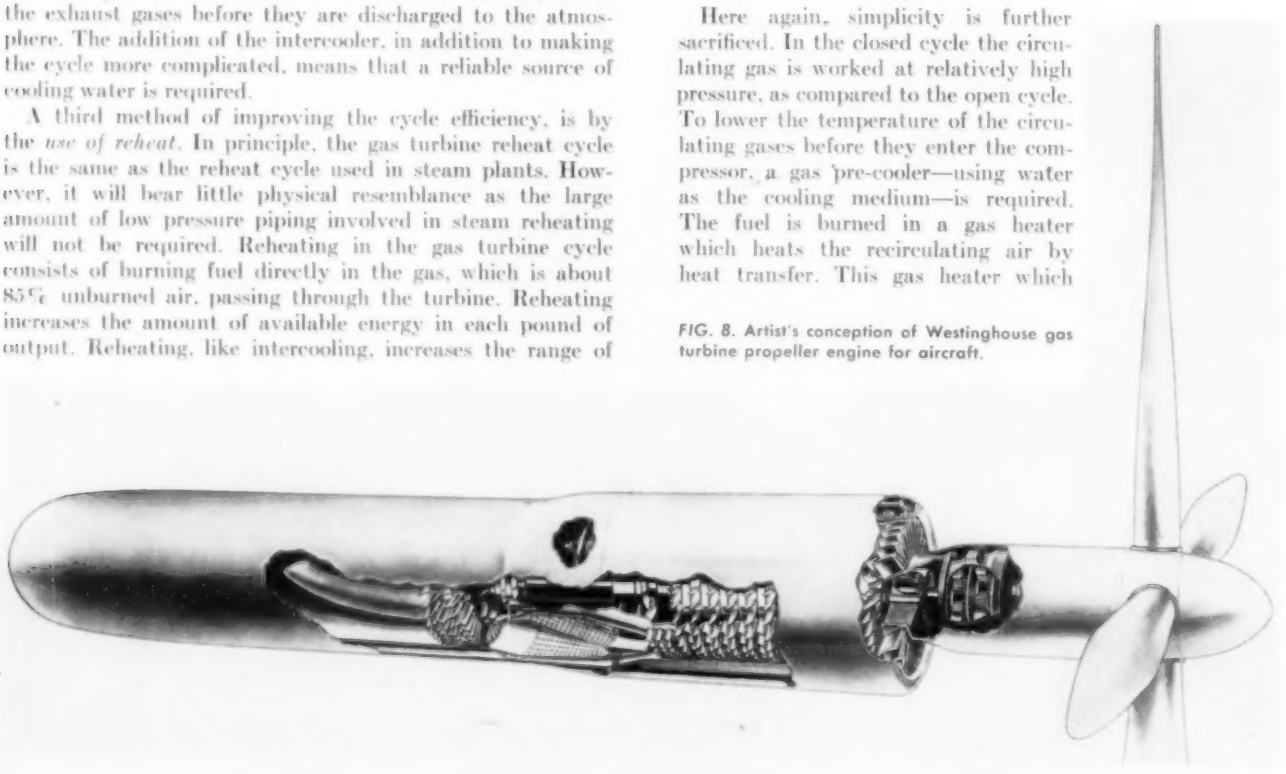
A third method of improving the cycle efficiency, is by the *use of reheat*. In principle, the gas turbine reheat cycle is the same as the reheat cycle used in steam plants. However, it will bear little physical resemblance as the large amount of low pressure piping involved in steam reheating will not be required. Reheating in the gas turbine cycle consists of burning fuel directly in the gas, which is about 85% unburned air, passing through the turbine. Reheating increases the amount of available energy in each pound of output. Reheating, like intercooling, increases the range of regeneration. The addition of all three elements gives a cycle with an optimum efficiency, at a pressure ratio slightly higher than a simple open cycle at the same temperature.

Some idea of the gain in efficiency to be obtained by these three methods alone, and in combination are given in Fig. 5. For the simple open cycle the thermal efficiency at 1200°F. is 20%. Holding this 1200°F. gas temperature and adding a 75% regenerator heat exchanger the efficiency is increased to approximately 27%. If, in addition, one stage of intercooling and one stage of reheating are added the efficiency is increased to approximately 32%.

At the present time, the limiting net output of the simple, single turbine open cycle unit is about 7500 kw, or even less —this requiring a 30,000 kw turbine with a gas flow of about 750,000 lbs/hour. Means have been disclosed which materially increase the limiting unit capacity of the open cycle, wherein the system is closed, and the compressor inlet pressure is pumped up to several atmospheres in order to reduce the gas volume. Theoretically, this system permits the unit capacity to increase many times, and to match most central station steam power unit ratings. A closed cycle is illustrated in Fig. 6.

Here again, simplicity is further sacrificed. In the closed cycle the circulating gas is worked at relatively high pressure, as compared to the open cycle. To lower the temperature of the circulating gases before they enter the compressor, a gas pre-cooler—using water as the cooling medium—is required. The fuel is burned in a gas heater which heats the recirculating air by heat transfer. This gas heater which

FIG. 8. Artist's conception of Westinghouse gas turbine propeller engine for aircraft.



replaces the simple, compact combustor of the open cycle is large and expensive, and it requires large amounts of high temperature materials for its heat transfer surface.

As this closed cycle keeps the products of combustion out of the turbine and compressor circuit, the problem of using coal as a fuel should be much simpler of solution than in those cycles which circulate the products of combustion through the turbine. The efficiency of the closed cycle for various combinations of a 75% regenerator with intercooling and reheating can be obtained from Fig. 5, provided an allowance of about 90% is made for the efficiency of the air heater.

The possible applications of the gas turbine are numerous and important. In the simple open cycle form for small capacity and in the closed cycle unit for large ratings, the device offers possibilities of competing with most types of engines and prime movers.

During the war, the development of the simple open cycle gas turbine for jet propulsion of high speed fighting planes was the application that captured the public fancy and aroused tremendous interest in gas turbines. The application of the gas turbine jet engine to fighting ships has now passed the experimental stage, and the jet propelled plane is already an established part of our military forces.

Fig. 7 shows a cutaway illustration of an aircraft jet propulsion engine. It consists of the three elements of the simple open cycle gas turbine: compressor, combustor and turbine arranged in line. In this type engine, all of the power output is used to accelerate air taken into the engine to a jet of approximately acoustic velocity, which is expelled through the exhaust nozzle. Its advantage over the reciprocating engine is due to the characteristic inherent in turbine apparatus of efficient operation at high speeds, resulting in small physical size and weight of parts. At high plane speeds, the reciprocating engine takes upwards to one-half of its total power output to drag itself through the air. In addition, at speeds above 350 miles per hour, the propeller efficiency falls off rapidly, while the jet efficiency (within limits) increases with speed.

For commercial aviation, where extreme speeds may not be economical, the gas turbine propeller engine is being perfected. An artist's conception of such an engine is shown in Fig. 8. The gas turbine, geared to a propeller, has the advantages of a jet engine with respect to drag reduction and ease of installation. At the same time, it retains the high propulsion efficiency of the propeller at low speeds. The gas turbine propeller drive has a better fuel consumption than the large reciprocating engines. For all conditions except extremely high speed (above 550 miles/hr.) and low power (below 1000 hp) the gas turbine propeller engine appears to be the aircraft power plant of the future.

In the field of railway transportation, the gas turbine is expected to offer strong competition to existing types of drives. At least one successful installation has been made in Europe; and much thought and planning is being given to the problem in this country. Westinghouse is now testing a 2000 hp experimental gas turbine operating on the simple cycle (Fig. 9).

We have employed the simplest type of cycle and have introduced innovations in the design of all components with the intention of making this gas turbine plant a reliable, compact and reasonably efficient prime mover for marine, transportation, and some industrial applications. The unit is designed for a maximum temperature of 1350 deg. F., and the best available high temperature materials are used.

The closed cycle, with its reduction in size of rotating and heat exchange machinery, offers a method of getting around the capacity limitation of the open cycle. It is this system from which units of from 10,000 kw to 50,000 kw ultimately may come. A successful experimental closed cycle has been

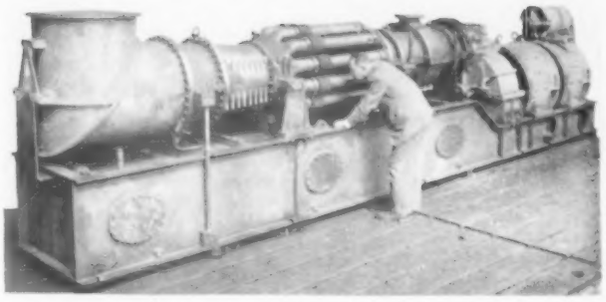


FIG. 9. Shop view of 2000 hp experimental gas turbine designed for operation at 1350°F.

in operation in Europe for some time. Design and economic study of this cycle, however, indicates that it may be relatively expensive as compared to a steam cycle.

Widest industrial application of the gas turbine will not take place until the problem of the use of coal is solved. This problem is being vigorously attacked by several different groups in this country at the present time. Westinghouse has recently completed a new combustion laboratory at East Pittsburgh and a major component of its facilities has been designed and arranged for research on solid fuels.

Industry will require several years of experience in the building of gas turbines before material and manufacturing processes will be sufficiently developed to permit real comparison of cost of the gas cycle with the established prime movers such as steam turbines and diesels. What the future application of the gas turbine will be, it is difficult to predict, particularly as its range of application is so broad.

One thing is certain, that the reduction of the gas turbine to practice in all of its phases will require the further expenditure of considerable time and money, both in the research laboratory and the actual plant. Westinghouse is of the opinion that there is a broad field for the gas turbine. To take care of this business, greatly enlarged research and gas turbine testing facilities are now being created. We realize that the gas turbine is not going to spring into perfected existence overnight. Its place as a competitive prime mover can only be won by hard work and continued research.

Resume of paper originally scheduled for the Semi-Annual Meeting, A.S.T.E., at Pittsburgh, Pa.

Disposal of War Surpluses Huge Task

WHEN A 35 BILLION dollar sales job includes $5 pneumatic life rafts for fishermen, machine tools for industry, and such items as 150 million dollars worth of scrap metal, and $35,000 worth of left-over cotton duck for repair of the sails of China's war-ravaged fishing fleet—it is easy to see that such a task calls for tremendous administrative effort.

While various individuals attempt to inject favoritism or misconduct into WAA's disposal setup (during the second quarter of 1946, over 1,200 investigations of irregularities, favoritism or misconduct were started) the great majority of cases proved to be unfounded after due investigation.

Objectors to WAA's program include those who feel that schools should be given surplus machines and tools for vocational programs as outright donations, instead of being forced to buy them under the 40% discount arrangement, which has consequently deterred schools from getting needed tools from the ever-increasing number of governmentally sponsored sales.

WAA officials predict that the highest peak in surplus property sales will not be reached until July, 1947.

By A. E. Rylander

Welding Fixtures for Mass Production

Simple Fixtures and Straight Line Flow of Materials Result In Ease of Operation and a Very High Production Potential

Installment No 2

IN THE PRECEDING INSTALLMENT, we presented alternate methods—as with welding positioners and straight line flow—for welding the assembly which, as a refresher, is reproduced here. Note Fig. 1. The welds A to AK, B and BB, and C and CC, will be referred to in discussing the fixtures. Also reproduced, as a refresher, and shown here as Figs. 2 and 3, are the station sequence and flow charts of the various operations. These, too, will be reconciled with the fixtures, the whole aimed to assist the reader in following the operation sequences.

It will be recalled that we are dealing with a fairly heavy and bulky structure, at an assumed production rate of 100 per 8-hour day. This implies one unit coming off the line about every four minutes, and all operation sequences are timed to this output. Furthermore, the flow is straight line, with the weldments moving from fixture to fixture by means of mechanical pushers. There are no crane lifts except at the end of the line where positioners are used for inspection and repairs.

The conveyors (or conveyor fixtures) are all of a height, floor to top of rollers, which will permit ready transfer from one fixture to the next. This, however, does not necessarily mean that the rollers are of equal height from the floor. If, for example, the weldment (which is 36" wide x 18" high) is turned edgewise in transfer, then the rollers of the succeeding fixture will be 9" lower than those in the preceding fixture, and vice versa.

Referring to Figs. 2 and 3, and following the operation sequences in order, we have:

Station 1. Assemble bottom member (Detail, Fig. 1) to one side member (Det. 2). Tack weld.

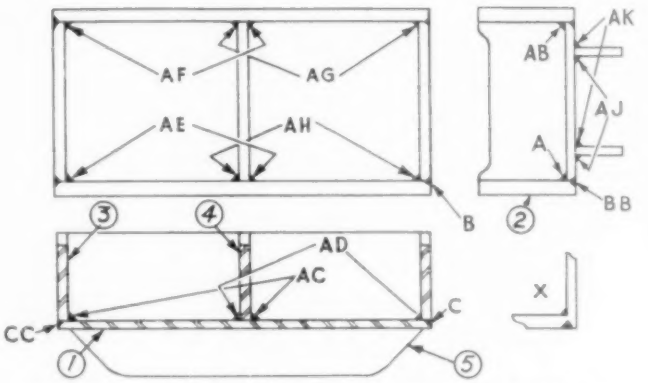


FIG. 1. The weldment, reproduced from Installment No. 1, this series.

Sta. 2. Weld fillet A.

Sta. 3. Tilt in opposite direction.

Sta. 4. Assemble opposite side members to bottom plate.

Sta. 5. Weld fillet AB.

Sta. 6. Tilt weldment to horizontal.

Sta. 7. Assemble end and center cross members, Dets. 3 and 4.

Sta. 8. Stub roller carriage.

Sta. 9. Weld fillets AC, AD, AE, AF, AG and AH, also V-joint B, both ends.

Sta. 10. Same as Sta. 8.

Sta. 11. Rollover.

Sta. 12. Weld V-joints BB.

Sta. 13. Same as Sta. 11.

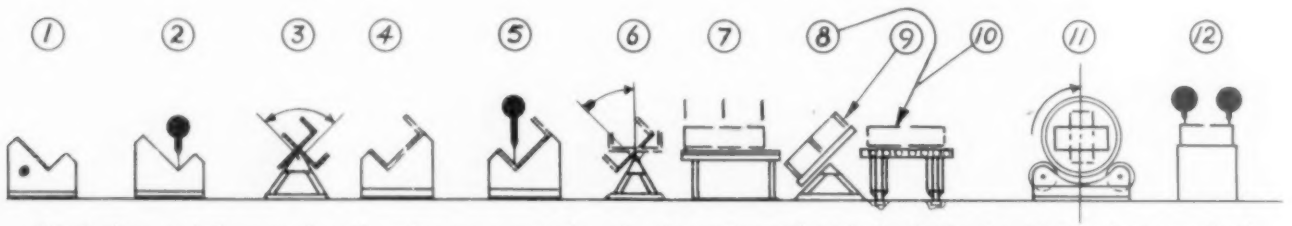
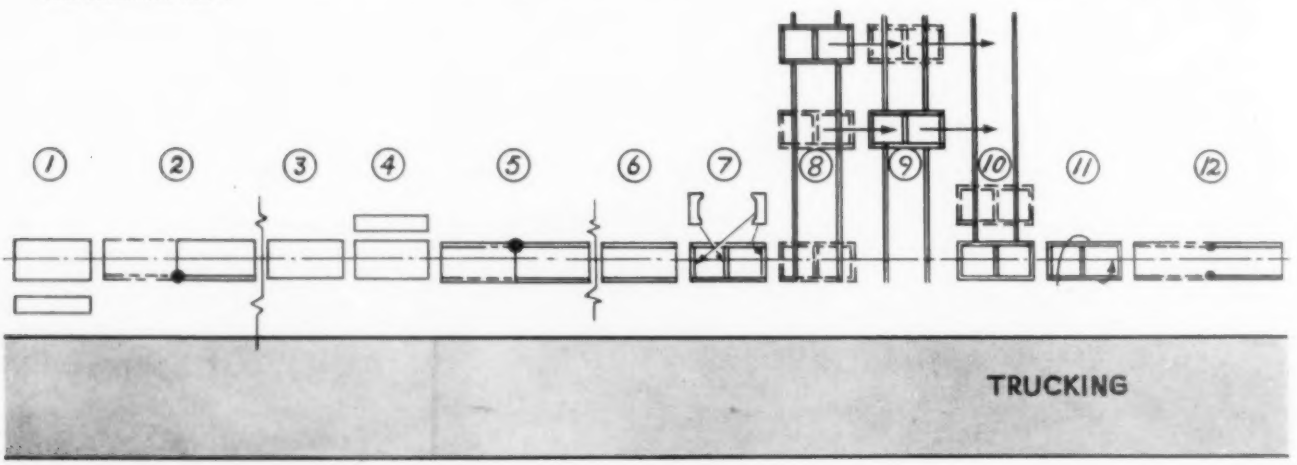
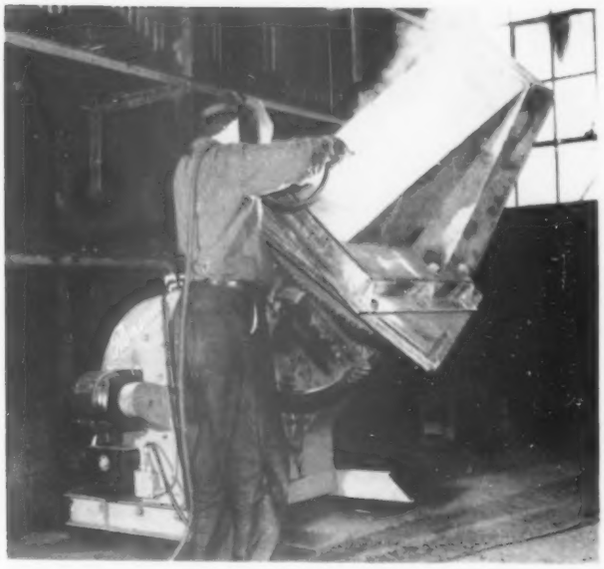


FIG. 2, above, on both pages, shows the station sequences in the order of operations performed. Figs. 2 (above) and 3 (below) are reproduced from Installment No. 1.



The Model 30 Ransome Welding Positioner, product of Ransome Machinery Company, Dunellen, N. J. The unit shown is of 3000 lbs. capacity. Other Ransome Welding Positioners range from 500 to 40,000 lbs. capacity.



Welding positioners, which may be rotated or tilted to most advantageous angles, are ideal tools for welding cumbersome or intricate assemblies, as shown above. Photo by courtesy of Ransome Machinery Company.

Sta. 14. Weld bevel joints C and CC.
Sta. 15. Same as Stas. 11 and 13.
Sta. 16. Assemble keels, Det. 5, Fig. 1.
Sta. 17. Weld fillets AJ.
Sta. 18. Weld fillets AK.
Sta. 19. Tilt weldment to horizontal.
Sta. 20. Same as Stas. 8 and 10.
Sta. 21. Same as Stas. 8, 10 and 20.
Sta. 22. Annealing furnaces.
Sta. 23. Same as Stas. 8, 10 and 20.

With this sequence of operations again in mind, and available for ready reference, we will now discuss the fixtures used.

The fixture for Sta. 1 is shown in Fig. 4. To all practical purposes, this is a simple angle fixture made of plate and structural steel and provided with rollers and locators. The latter are hinged, for clearance and easy assembly. As the parts are fairly heavy—say about 350 lbs. each—they would be lifted from the floor by means of jib cranes provided with lifting magnets. As disposed, the crane would not interfere with adjacent stations.

Note that the side member is tipped away from vertical, in relation to the bottom plate. See dotted line, which is at 90° to bottom plate. The weldment is purposely predistorted, in assembly, so that it will square up as the weld cools. At this (No. 1) station the two members are tack welded together, for temporary holding, then transferred to Sta. 2 by means of a mechanical pusher, not shown. However, the rollers would permit easy pushing by hand.

Fig. 5 shows the fixture for welding the fillet A. This fixture is also made from plate and structural steel. The height of the rollers exactly coincides with those of the

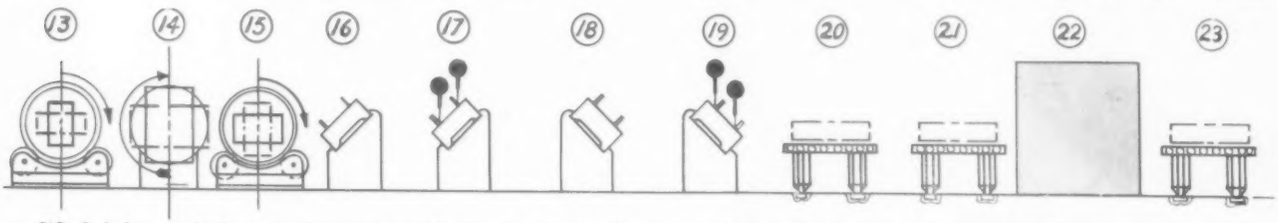
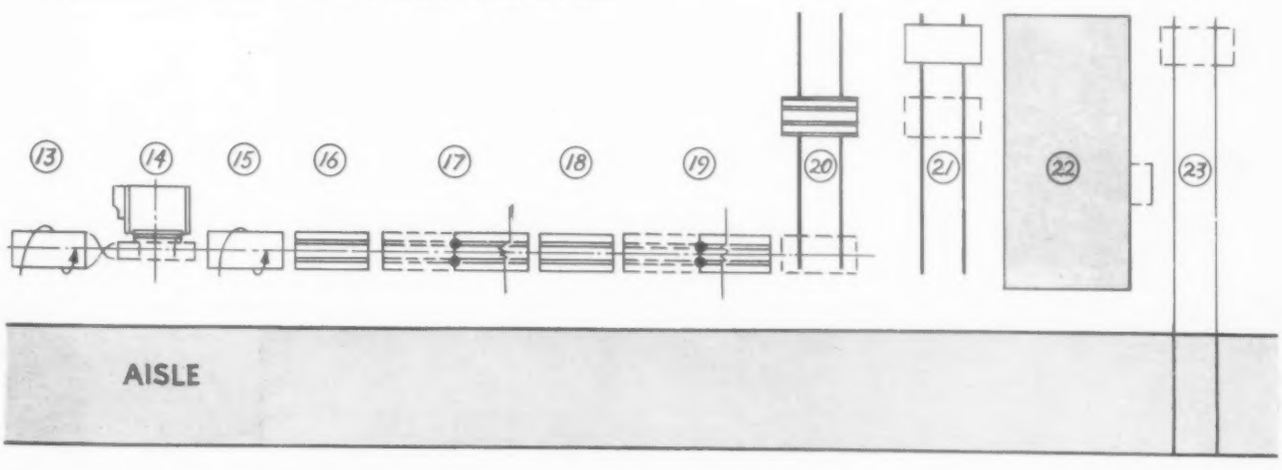


FIG. 3, below, on both pages, shows the straight line flow chart, with necessary laterals. The fixtures, to be discussed in three installments, may all be reconciled with the circled numbers above the various stations.



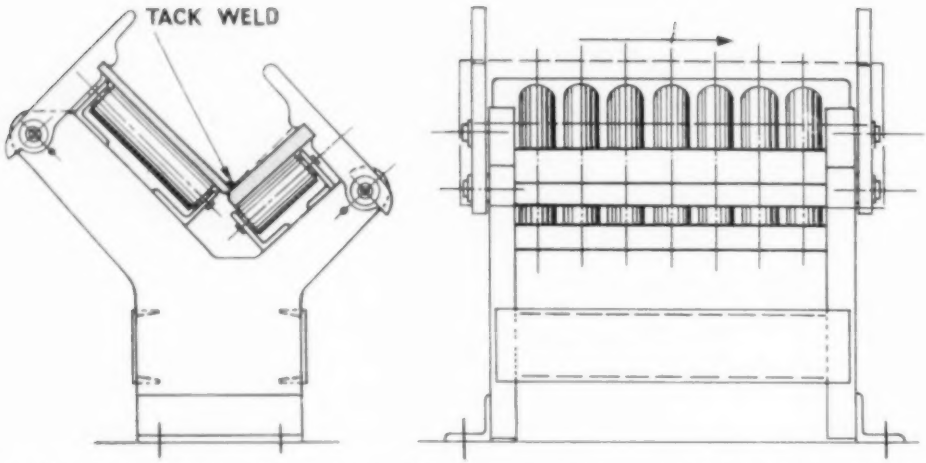


FIG. 4. The assembly fixture used at Sta. 1.

preceding fixture; hence, the weldment slides from one to the other without interference. Welding is automatic, using any of the automatic welding heads—as General Electric or Unionmelt—and the head is stationary, while the work, moved by a mechanical pusher, moves at a speed suited to the weld.

In this fixture, as in the preceding, the weldment is predistorted, but with the difference that the roller guiding the side member may be provided with a spring tension, as shown in small detail between the end and side views, Fig. 5. As the weld progresses, and the members warp into position (or at 90° to each other) the springs will "give" as the member straightens. Tension may be adjusted, to suit, by means of the hand knob shown.

After leaving Sta. 2, the weldment moves to Sta. 3, a tilting fixture shown in Fig. 6. The rollers are at the same height as those in the preceding fixture, and the angle of tilt (roughly 45°) coincides with that at Sta. 3. While the left hand—or opposite—side member is not installed in this fixture, the roller at the left, Fig. 6, may be stepped, as shown. This not only restrains the bottom plate from sliding as the fixture tilts, but provides means for installing the left hand side member should occasion demand.

Once the weldment is on this fixture, it is tilted by means of the hydraulic cylinder shown, a full 90° to present it at the proper angle (roughly 45°) for entry into Sta. 4, where we assemble and tack weld the left hand side member. Here, too, lifting magnets are used to lift the part. This fixture (Fig. 7) is similar in principle to Fig. 4; however, the bottom rollers have a deep Vee, sufficient to hold the side member in place once it is tack welded. The upper roller merely serves as a rest.

From Sta. 4 the weldment progresses to Sta. 5, the fixture for which is shown in Fig. 8. This fixture, except for being the opposite hand, is a near duplicate of Fig. 5, about the only difference being in the upper right hand roller. Here,

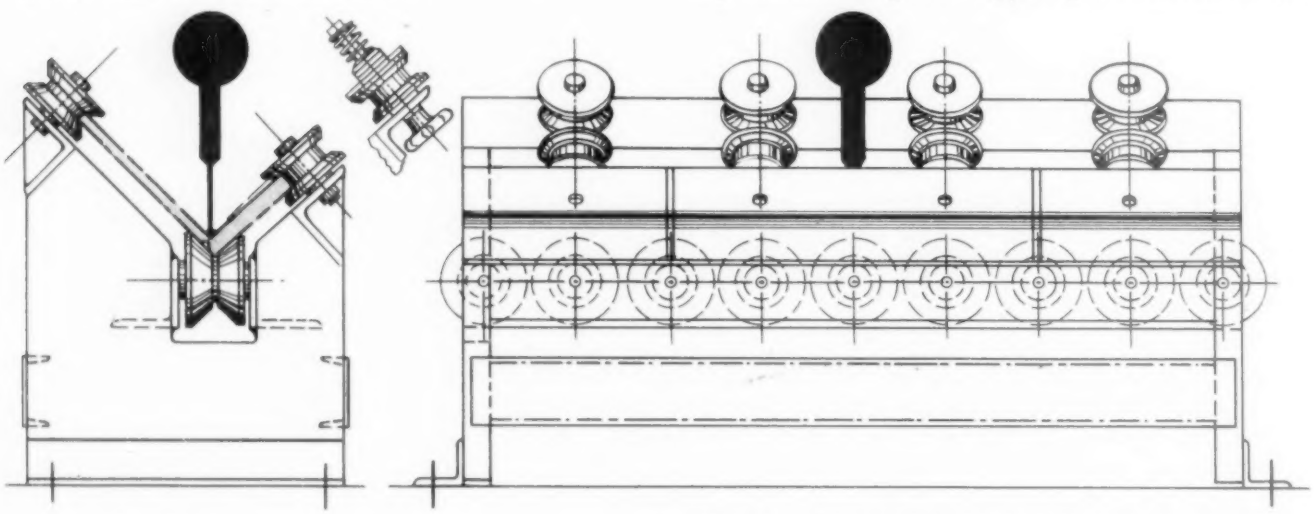
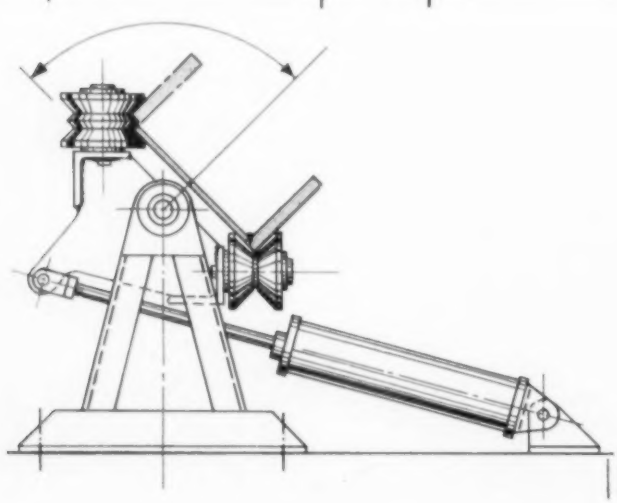


FIG. 5, above, fixture used to weld fillet A, Sta. 2. Fig. 6, at left, tilting fixture used at Sta. 3.



we weld fillet AB, the weldment moving along, by mechanical pusher, at the same rate of travel as at Sta. 2. Welding is automatic. Side views, of Figs. 7 and 8 are not shown; however, they would be largely similar to those in Figs. 4 and 5. The illustrations, Figs. 7 and 8, omit the spring tension roller; however, compensation should be made for distortion as the weldment cools.

At Sta. 6, we use a tilting fixture, as shown in Fig. 9, and tilt the weldment to horizontal. To all practical purposes, this fixture could be the duplicate of Fig. 6, except for the difference in rollers and the use of a shorter stroke cylinder, since the tilt from angular to horizontal is only 45 degrees.

At Sta. 7, we assemble and tack weld the end and center cross members, Details 3 and 4, Fig. 1. The fixture, here, need only be a conventional roller conveyor, as suggested

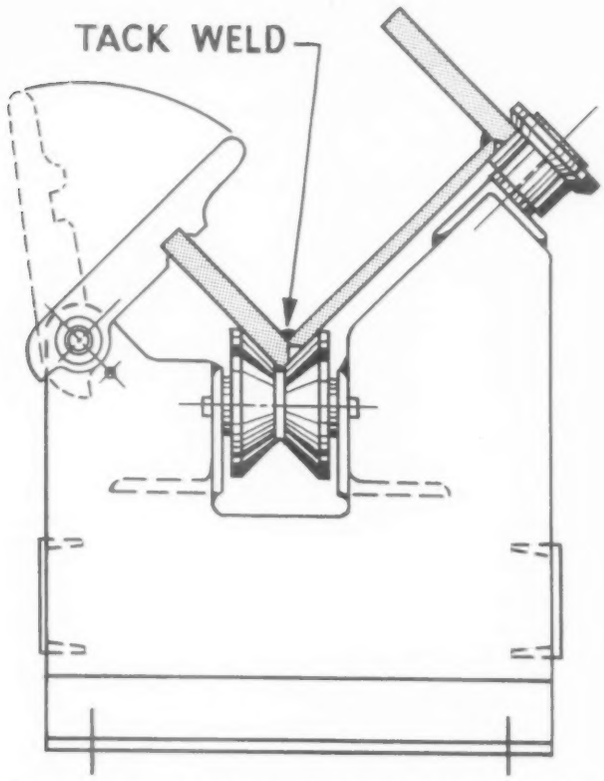
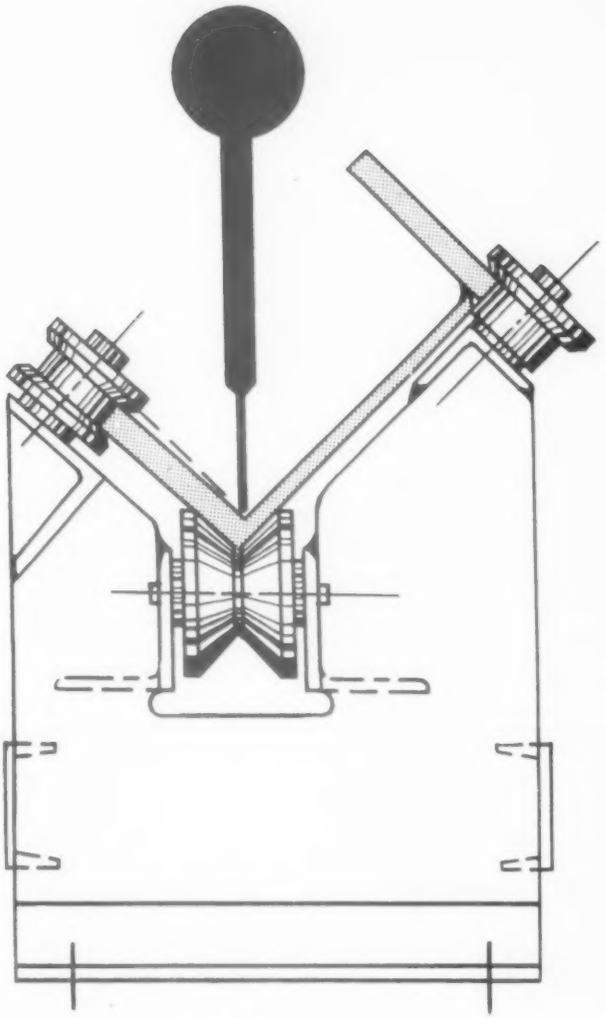


FIG. 7, above, assembly fixture used at Sta. 4. Fig. 8, at right, fixture used to weld fillet AB, at Sta. 5.

FIG. 9, at right, below, fixture used to tilt weldment at Station 6.



by the two stub ends shown in Fig. 10. The cross members should slip easily into place between the two side members —provided the original predistortion was such that, in cooling, the members straightened to 90° in relation to the bottom plate.

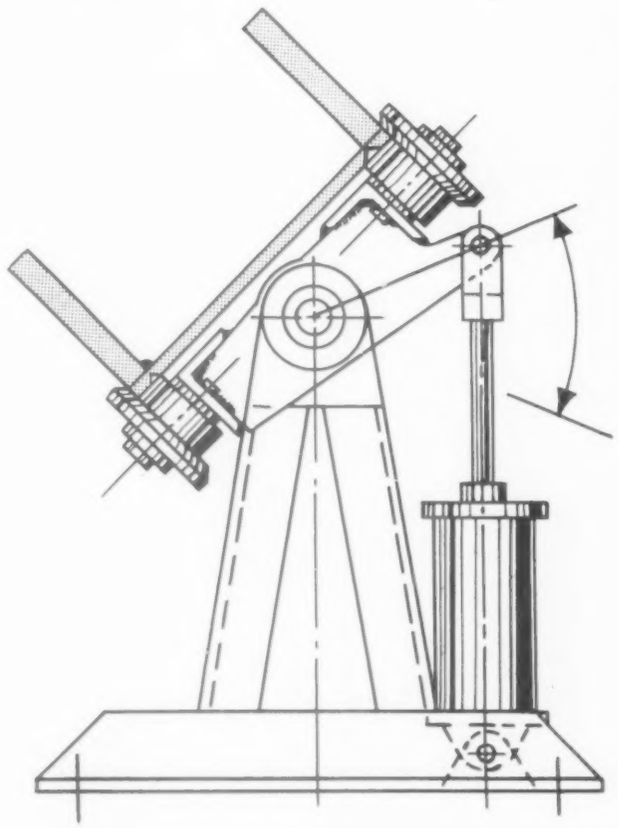
Once the cross members are in place, the weldment is transferred to the shuttle carriage, Sta. 8. See Fig. 10. This is merely a stub roller conveyor mounted on a wheeled carriage which moves on a track lateral to the main line. It will be noted that Stas. 8, 9 and 10 combine into a lateral, where the bevel joints C and CC; and fillets AC, AD, AE, AF, AG and AH are welded. These joints are hand welded; and the time required, per unit, is 1 hour. Consequently, 15 fixtures (Fig. 11) are required.

Lest the reader be perturbed by a slight inconsistency between the flow chart, Fig. 3, and the fixture shown in Fig. 11, it should be explained that a short stub conveyor is interposed between the fixture and the shuttle carriage. This is so that the carriages may shuttle past the several fixtures without interferring with the operators.

By referring to Fig. 10, it will be seen that the track consists of structural channels sunk into the floor, an arrangement that not only provides an inexpensive track and plain wheels, without flanges on the carriage, but eliminates any raised obstruction over which one might trip.

The weldment is transferred from Sta. 7 directly into the shuttle carriage, which then moves laterally to any fixture, at Sta. 8, which may be open. One may reasonably assume that at least one station would be open at 4-minute intervals; however, it might be well to provide one spare station for possible accumulation.

The fixture (Fig. 11) is provided with stops and latches, to prevent the weldment from rolling off as the fixture tilts. As will be seen, the fixture is tilted by a hydraulic cylinder, while hydraulically actuated latches, on the stub conveyors, securely lock the stub and fixture together during interval of transfer.



Once back on the main line, the weldments are transferred from the shuttle carriage (Sta. 10) to a rollover fixture, shown in Fig. 12. This fixture is a cage, made up of plate and structural steel and provided with rollers. Here, the weldment is rotated 180°, to be transferred to the succeeding station upside down.

Once inverted, the weldment is transferred to Sta. 12, where the fixture is a simple roller conveyor, made up of structural steel, as shown in Fig. 13. Here, we weld the V-joints, BB, using Unionmelt, which permits making the weld in one pass. The weldment moves, actuated by a mechanical pusher, at the required speed. The welding heads are shown, symbolically, in silhouette.

It may be suggested, here, that the weldment is now a rigid box section, braced by the cross member, and with all inside—and all but two—end welds completed. Hence, no clamping is required, the weight of the unit holding it down against the rollers. The flanged wheels guide it straight, so that there is no marked deviation, from a straight line, for the welding. We could, here, move the welding heads, but that would complicate the setup and waste time, since the heads (welding machines) would have to travel the full length of the weld, and then return to starting position. It is much simpler and less expensive to move the weldment along the simple conveyor.

The V-joints welded, the assembly moves into another rollover, which can be an exact duplicate of the one at Sta. 11. Here, however, the roll is only 90 degrees, for transfer to the next station in edgewise position; hence, a simpler fixture could be employed—say one like Figs. 6 or 9, but with a cylinder of sufficient stroke for a 90° roll. There is, however, a certain advantage in duplicating these fixtures, since they could be made from the one design with the further advantage of duplicated parts.

From the rollover, the weldment goes to Sta. 14, where we weld the bevel groove joints, C and CC. Here, we use a welding positioner, with the table set 90° in relation to the floor and provided with a stub roller conveyor, as shown in Fig. 14. The weldment slides into the stub conveyor and comes to rest against a retractable stop, while a latch, on the opposite end, prevents rollback. The weldment is clamped to the table by means of hydraulically actuated clamps.

Once secured, the table is rotated 90° and locked with an index pawl, not shown. Welding is automatic; in this case, however, it is much simpler to move the head for the comparatively short travel—36"—although, if so desired, the positioner could be mounted on a track and moved to-and-fro with a long stroke hydraulic cylinder. The welder head can be moved by cylinder, chain, worm or by its own carriage, as desired.

One end done, the table is rotated 180° for welding the opposite end; then, a further rotation of 90° returns the weldment to its original position—i.e., with the stub conveyor at the bottom. It is then slid off onto Sta. 15, which is another rollover similar to those at Stas. 11 and 13. While still at Sta. 14, however, it might be well to suggest that the positioner used be adequate to the load. At this point, the weldment would weigh in the neighborhood of 1800 lbs.; hence, a positioner of 3000 lbs. capacity would be needed to take care of this weight plus that of the conveyor and incidental attachments.

From the rollover, Sta. 15, the weldment is transferred to a tilting fixture (Fig. 15) at Sta. 16, for assembly of the two keels, Det. 5. The parts are positioned by means of two locating gages, shown at the upper left in Fig. 15, and tack welded for temporary holding. The fixture is then tilted to 45°, approximately (or to the exact angle of the succeeding fixture) and moved to the conveyor fixture shown in Fig. 16, Sta. 17.

Here, we weld the fillets AJ, the weldment moving at a predetermined speed under stationary welding heads. Because of the proximity of the welds, due to the 45° tilt, the welding heads are staggered, one slightly ahead of the other, to avoid interference.

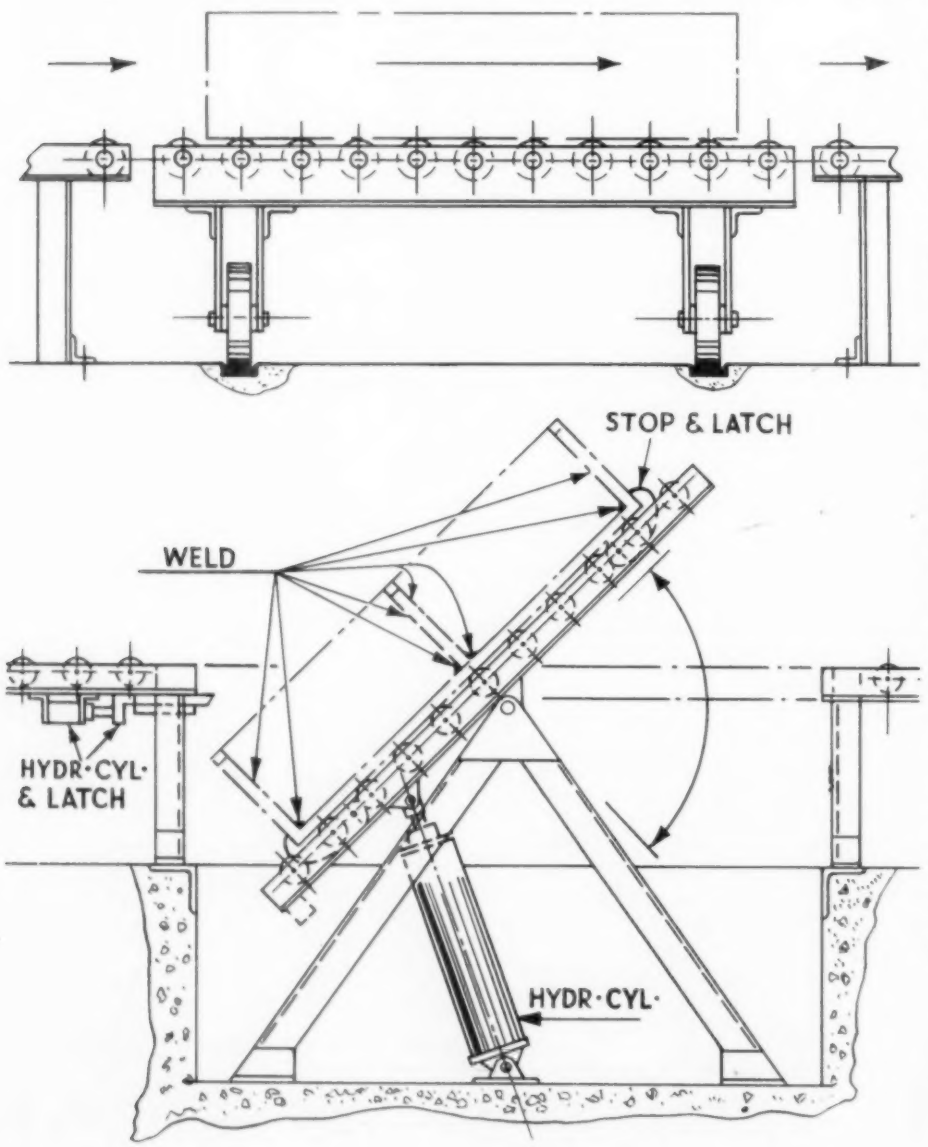


FIG. 10. At left, above, shuttle carriage, used at Stas. 8 and 10, to transfer weldments from main assembly line to tilting fixtures (Sta. 9) shown in Fig. 11, left, below.

The welds completed on one side, the weldment slides off Sta. 17 onto a fixture (Sta. 18) which is a near duplicate of Fig. 15, except that the tilt ranges from 45° left hand to 45° right hand—or through 90° instead of 45°. From this tilting fixture, the weldment slides onto Sta. 19, which is an exact duplicate of the fixture, Fig. 16, except that it is turned end-for-end so as to present an opposite angle. Here, the opposite fillets—AK—are welded—and this completes the welding operation.

Alternate Method

Now, it may have been preferable to join the bottom plate and side members—Dets. 1 and 2—at the sides, as shown at Det. X, lower right, Fig. 1. In that case, the V-joints could be welded in the fixture as shown in Fig. 17. This fixture, like those previously discussed, is very simple; and the rollover, from one side to the other, would be effected by the fixtures shown for Stas. 11, 13 and 15.

Having completed the welding, we next transfer to an inspection station, located adjacent to Sta. 20, which, like Stas. 21 and 23, are shuttles similar to Stas. 8 and 10. As the weldments come to the shuttles in inverted position—i.e., bottoms up—inspection can be affected visually while the weldments are on the carriages.

Should X-ray inspection be in order, it would be necessary to divert the weldments for this purpose; in either event, they would have to be inverted to inspect the inside welds. Again, we may have to resort to rollovers; or, we could pick up the assembly with cranes and inspect on positioners. For that matter, a battery of positioners would be required to take care of repairs—that is, unless we are so optimistic, or so sure of results, that we entirely preclude the possibility of welding flaws. Unfortunately, we cannot count on such super-perfection.

Naturally, strains will be set up during welding, and these may have to be relieved by stress annealing. For this purpose, we would use commercial furnaces obtainable from any one of several makers of such equipment. One consideration is that the furnaces be provided with doors at both ends and, preferably, be long enough so that two units could be annealed simultaneously.

Coming off the line—as at Sta. 19, final operation—the weldments would be transferred to a shuttle carriage (as shown in Fig. 11) and moved along the lateral track for inspection. After inspection, they would be moved to a shuttle carriage, the track for which could be adjacent to the furnaces. They would then be placed on pallets, to be pushed into the furnace from the entry end and pulled out at the exit end.

Leaving the furnaces, they would be placed on another shuttle carriage, as at Sta. 23, whence they would be moved to any open, convenient area for cooling. From that point on, they could be moved by crane or industrial trucks to whatever operation may be needed—as sand blasting and painting—for finishing. This, however, is an "extra"; here, we are mainly concerned with welding and the handling necessary for welding.

At this point, one may assume that a considerable proportion of readers interested in production welding, will have critically considered both the layout and the fixtures with regard to their own welding problems. It is also entirely probable that alternative methods will have been considered, which may or may not be improvements on the methods shown.

It is not implied, in this article, that the fixtures shown are the best for the particular operation or operations sequences. As previously stated, the intent has been to convey ideas, not to lay down arbitrary rules. And, while considerable advantage accrues as a result of straight line flow and elimination of crane lifts, conditions would largely dictate the type or types of fixtures to be used for any particular job.

One question—and it's a natural—may be brought up with regard to the design and construction of the fixtures.

At right, Type CA Unionmelt Welding Machine. The rod feed motor is driven by compressed air and controlled by a solenoid valve actuated by the welding voltage. The carriage can be driven by the rod feed motor, or by a separate drive motor, as desired. This machine handles a maximum of 1200 amperes of welding current. Photo by courtesy of Linde Air Products Company, Unit of Union Carbide and Carbon Corp'n.

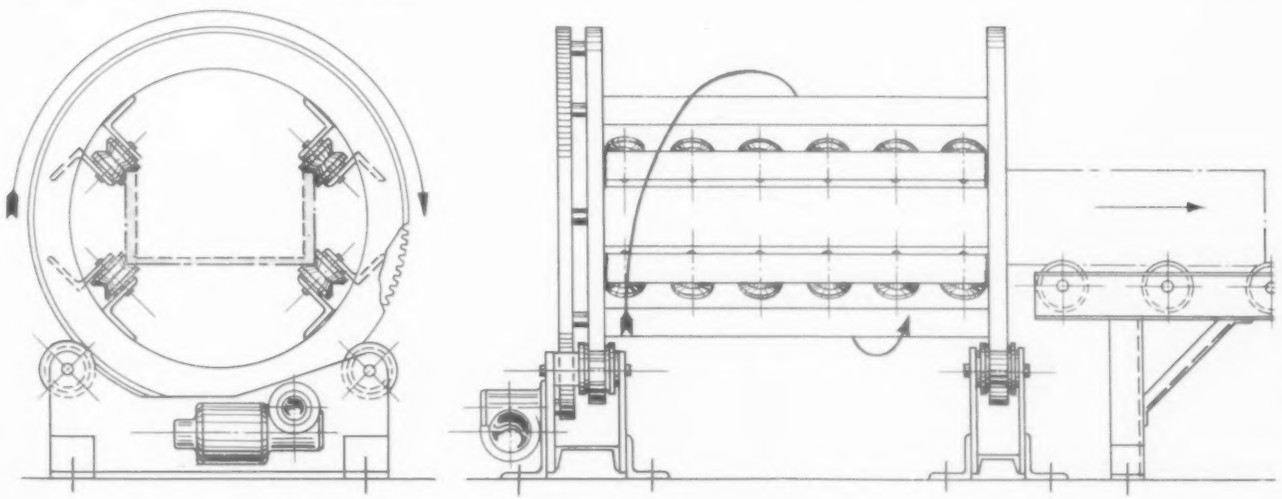


FIG. 12, below, rollover fixture, used at Stas. 11, 13 and 15 to invert weldment during transfer from station to station.

On cursory consideration, it may be assumed that they are rather expensive. That, however, is not so. Actually, fixtures of this type are rather simple, easy to design and as easy to fabricate.

Take, for example, the rollover shown in Fig. 12, which is perhaps the most intricate of the group. As shown, the natural assumption would be that the end rigs, and the gear, are cut out from solid plate stock. Actually, both the end members and the gear can be fabricated from segments, welded together, as shown in Fig. 18.

After joining the segments, a temporary cross bar, with a hole in the centre, can be bolted in place. If the center hole is accurately located in relation to the inside—say to close scale measurement—the weldment can then be mounted on a stub shaft and the O.D. accurately cut with the oxygraph. It will only be necessary to rotate the unit at a speed suited to the cutting.

When so cut, the O.D. will be almost as smooth as though turned in a lathe, and no further finish would seem to be necessary. However, one could rotate the unit on the shaft and grind the periphery against the flat of a wheel if a smoother finish is demanded. The angle iron longitudinals could then be welded in place, as shown in Fig. 18 instead of as in the original, Fig. 12.

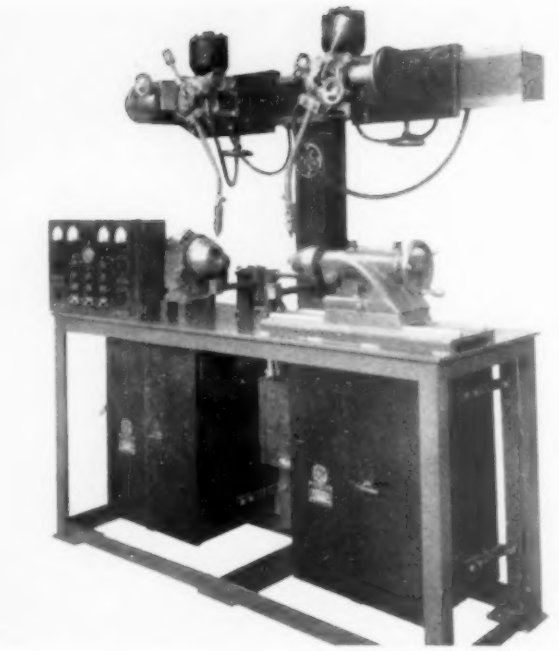
The same procedure would serve for the ring gear. And, instead of cutting the teeth, one could use commercial racks —as, for example, the racks made by Boston Gear Co., and usually available through local distribution. These racks would be heated and bent to the contour of the O.D., and welded in place.

Duplication Cuts Costs

Assume that a 4 pitch rack were used, and that the pitch diameter were 60". That would total 60 x 4 = 240 teeth which, at .7854 center distance between teeth, would imply a 188.496" of rack exactly—i.e., 240 x .7854 = 188.496". Then, subtracting twice the distance from the pitch line to the blank side of the rack would give us the O.D. of the ring.

If, for example, the depth of the rack, from pitch line to back face, were 1½", then the O.D. of the ring would be 60" minus 3", or 57". The racks would then be cut so that they would join on the spaces, where the welding could be easily dressed without disturbing the teeth.

If, now, we wished to employ a worm drive instead of pinion, we could run the worm at an angle corresponding to the helix angle. The gearing would then be self locking, providing an added factor of safety, although one would naturally design the fixture for balance even though the pinion drive were used. In any event, the gearing so designed and constructed would be accurate enough for all practical purposes. Similarly simple procedures would prevail for all



An unusually clean-cut setup for automatic arc circular welding, for mass production welding of cylinders 2" to 9" in diameter and 6" to 24" long. Photo by courtesy of General Electric Company.

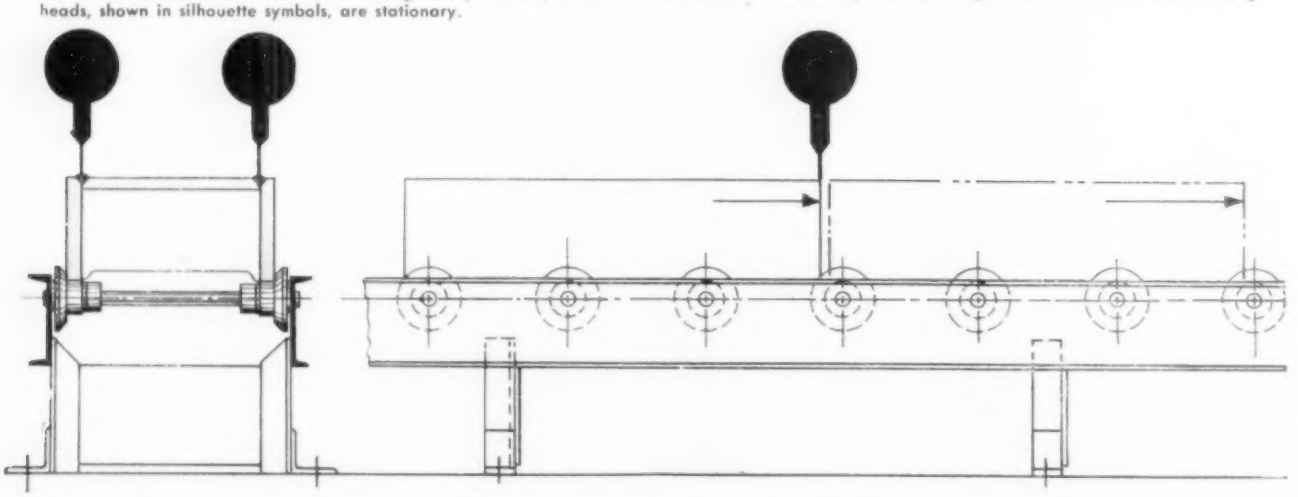
of the fixtures. The end plates—as in Figs. 4, 5, 6, 7, 8, 16 and 17, would all be cut to shape on the oxygraph. The other members for these fixtures, as well as the complete fixtures shown in Figs. 10, 13 and 14, would be made from structural steel. Every fixture is a welded assembly.

By duplicating the rollers, as far as possible, these could be machined complete on a turret lathe, thereby making a production run of the whole. One could use needle type roller bearings, when it would only be necessary to harden the rollers and studs for extended wear. Or, Oilite or other self lubricating bushings could be used.

Close accuracy, in assembling the rollers, is neither required nor necessary. One would space the rollers, inside to inside of flanges, for free slide for the allowable plus tolerance of the job being welded. This might imply a variation of as much as ¼" from minus to plus. This would reduce, in tracking, to about ⅛"—a negligible quantity where manual welding is concerned and easily compensated for in the case of automatic welding.

In the case of the Vee-shaped rollers, the weldment will slide in a straight line anyway and, should one require a

FIG. 13. Fixture used for automatic welding of V-joints, BB, at Sta. 12. Weldment is moved by mechanical pusher, not shown. The welding heads, shown in silhouette symbols, are stationary.



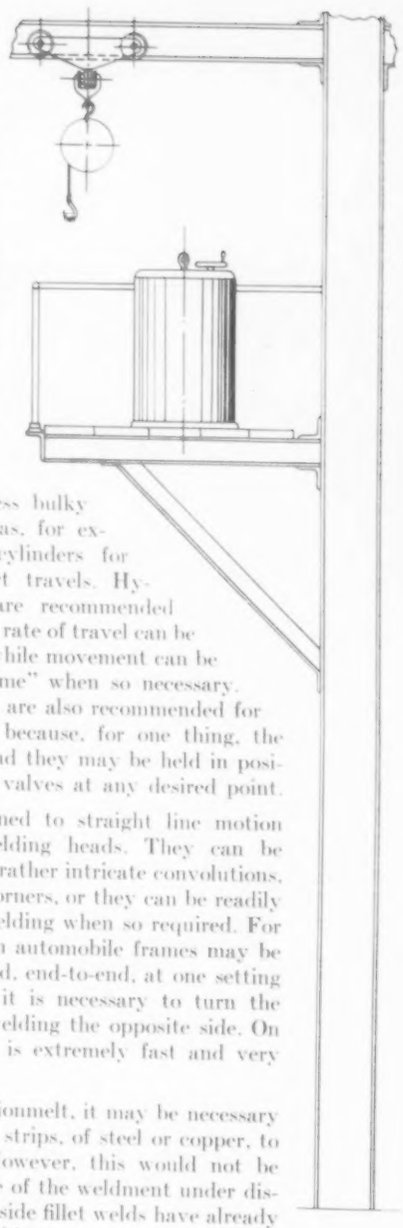
Synchroneous Motor Welder, one of several types manufactured by the Hobart Brothers Company, Troy, Ohio. The unit shown can be started across the line and automatically synchronizes itself by the build-up of a separate exciter.

closer straight line travel with the flanged rollers, this can be had by providing a spring tension along one bank. With the opposite bank of rollers thrusting against solid shoulders, the springs would then hold the weldment reasonably true along one side.

One thing that may be questioned, is the general absence of clamps on the various fixtures. It will be noted that only the fixtures shown in Figs. 4 and 7 are equipped with clamps —that is, barring Figs. 11 and 14, where clamps serve merely as retainers. For the weldment under discussion, however, clamps are hardly practical since the work is continuously moving except at the assembly stations; besides, the weight alone tends to hold the weldment down on the rollers.

It is not intended, here, to recommend any one make of welding machine, since such choice would be at the discretion of the plant welding engineer. Welding machines now available are good, and so controlled that the arc gap is automatically adjusted during travel of the machine, or the work, as the case may be. Rate of travel may be adjusted, at ranges from a few inches to around 200 inches per minute, depending on the nature of the work and thickness of the stock.

FIG. 14. Welding positioners, equipped with stub roller conveyor and clamps, for welding the bevel groove points, C and CC, at Sta. 14. The welding head moves to-and-fro to weld, and returns to starting position.

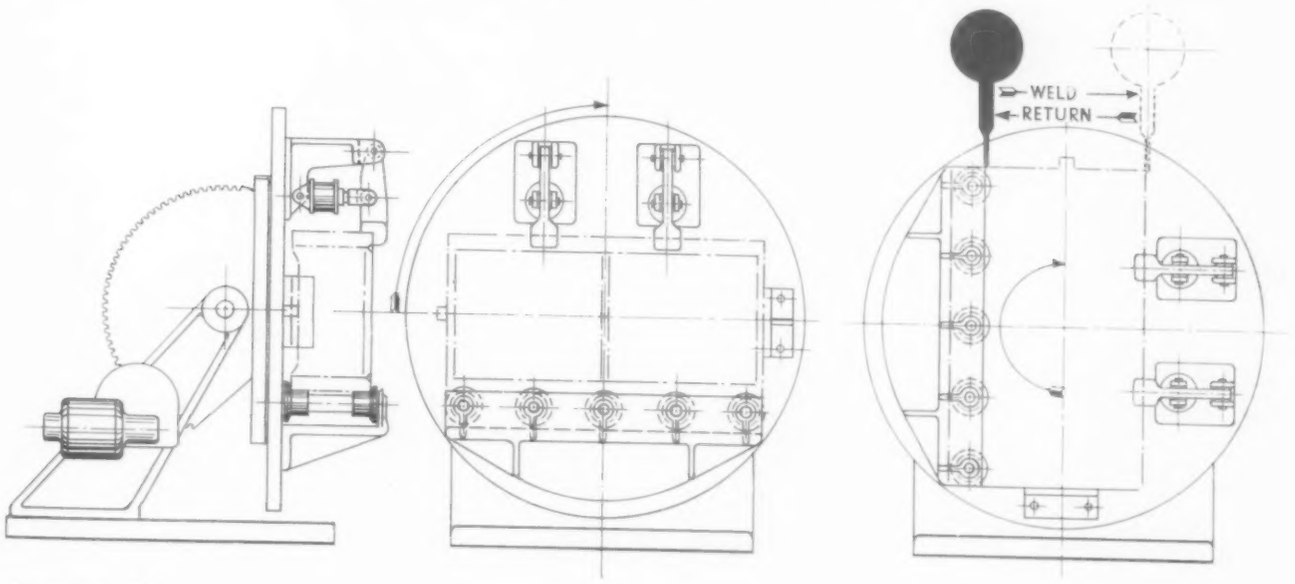


"Good housekeeping," with greater plant safety and increased floor space for work, results from disposing welding equipment—as generators and transformers—on balconies as shown at right. Units are hoisted in place by traveling hand cranes, and cables may be suspended by balancers to keep them off the floor.

While the welding machines may be had with self propelled carriages, it may be advantageous to use simpler and less bulky means for travel—as, for example, hydraulic cylinders for comparatively short travels. Hydraulic cylinders are recommended over air because the rate of travel can be closely controlled, while movement can be "stopped on the dime" when so necessary. Hydraulic cylinders are also recommended for tilting the fixtures because, for one thing, the action is steadier and they may be held in position by closing the valves at any desired point.

One is not confined to straight line motion with automatic welding heads. They can be made to weld along rather intricate convolutions, and to turn sharp corners, or they can be readily adjusted for skip welding when so required. For example, box section automobile frames may be automatically welded, end-to-end, at one setting per pass, although it is necessary to turn the frames over when welding the opposite side. On such work, welding is extremely fast and very accurate.

In the case of Unionmelt, it may be necessary to resort to backing strips, of steel or copper, to prevent blow-by. However, this would not be necessary in the case of the weldment under discussion, where the inside fillet welds have already provided a solid backing.



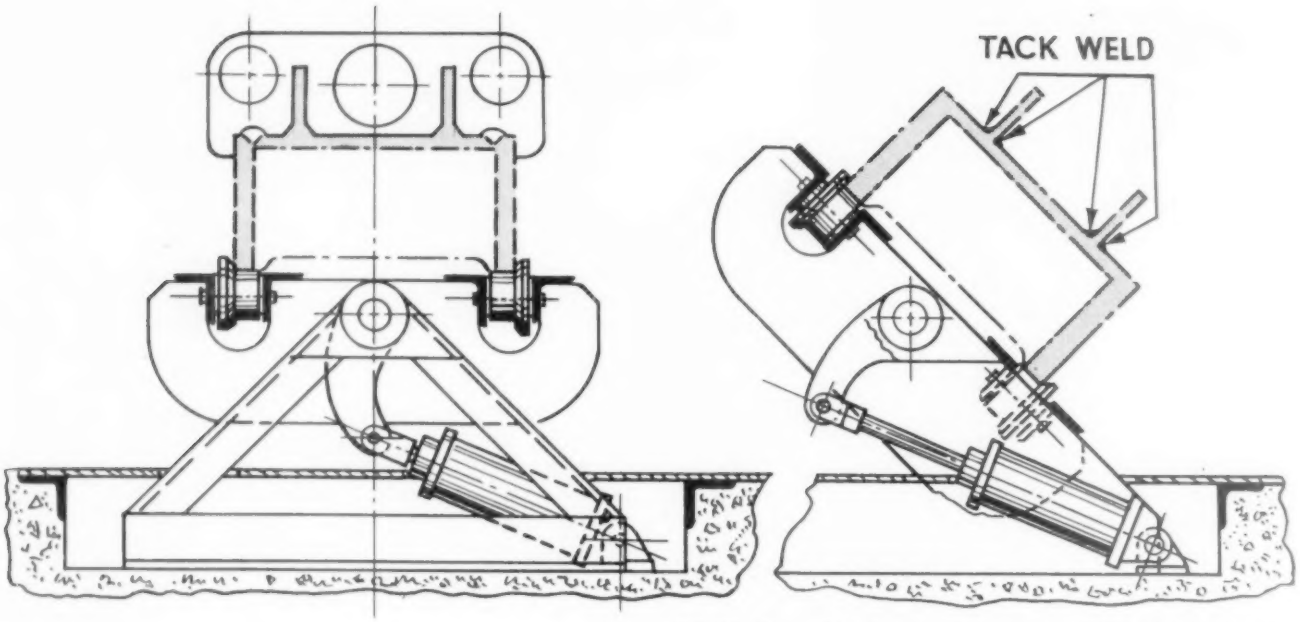
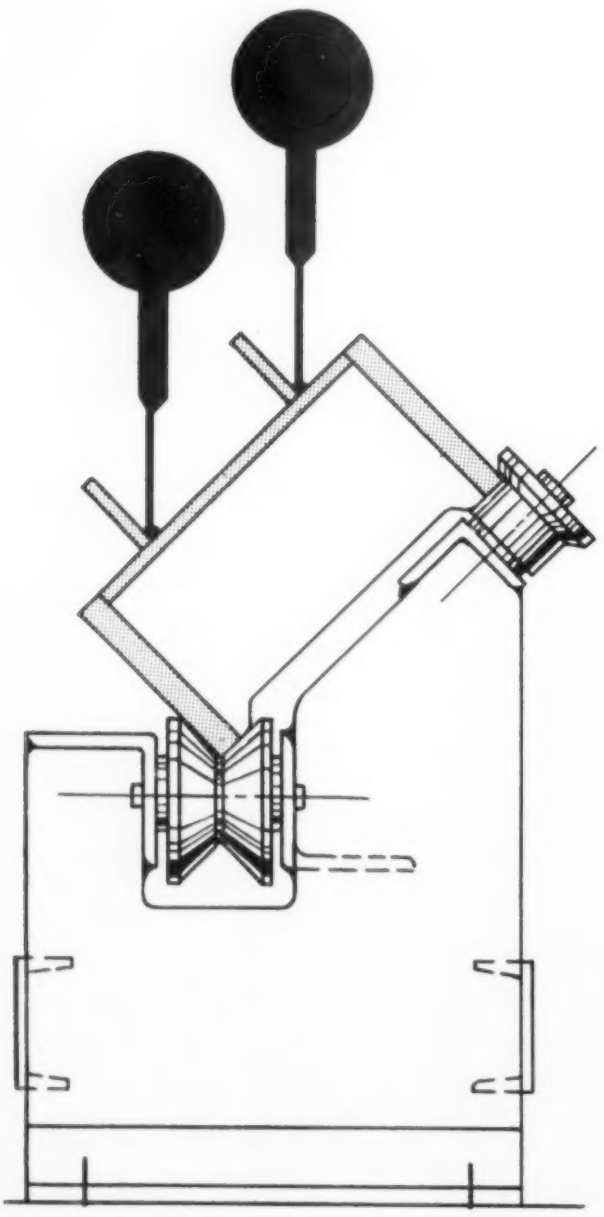


FIG. 15, above, tilting fixture used to assemble keels, (Stas. 16 and 18) which are located by means of gages, shown in place on the workpiece.

FIG. 16, at left, fixture used at Sta. 17, for automatic welding of fillet AJ. The same fixture, reversed for opposite side, is used at Sta. 19.



One recommendation, having to do with plant layout rather than fixtures, is that welding equipment—as welding generators and transformers—be mounted on balconies. Thus, one gains valuable floor space, the while cables can be suspended from commercial spring balancers and thereby kept off the floor. A typical balcony mounting is shown on the previous page. Room can be provided, along the building column line, for a service walkway, while demountable guard rails provide safety for anyone working on the balcony. The units are raised or lowered by means of hand cranes. Hydraulic pumps are preferably installed on subfloor levels, for return flow and drainage.

For handling the flat plates, as at Stas. 1 and 4, lifting magnets could be advantageously employed. Thus, there would be no need of hooks, which might slip, and the magnets could pick up the parts at the points most advan-

Powerful lifting magnets are ideal tools for gripping and lifting flat plates, as at Stas. 1 and 4. Parts may be "hooked" at most advantageous points for balance and assembly. The magnet shown is the Power-Grip Hoisting Magnet, manufactured by the Rockford Magnetic Products Co., Rockford, Ill.

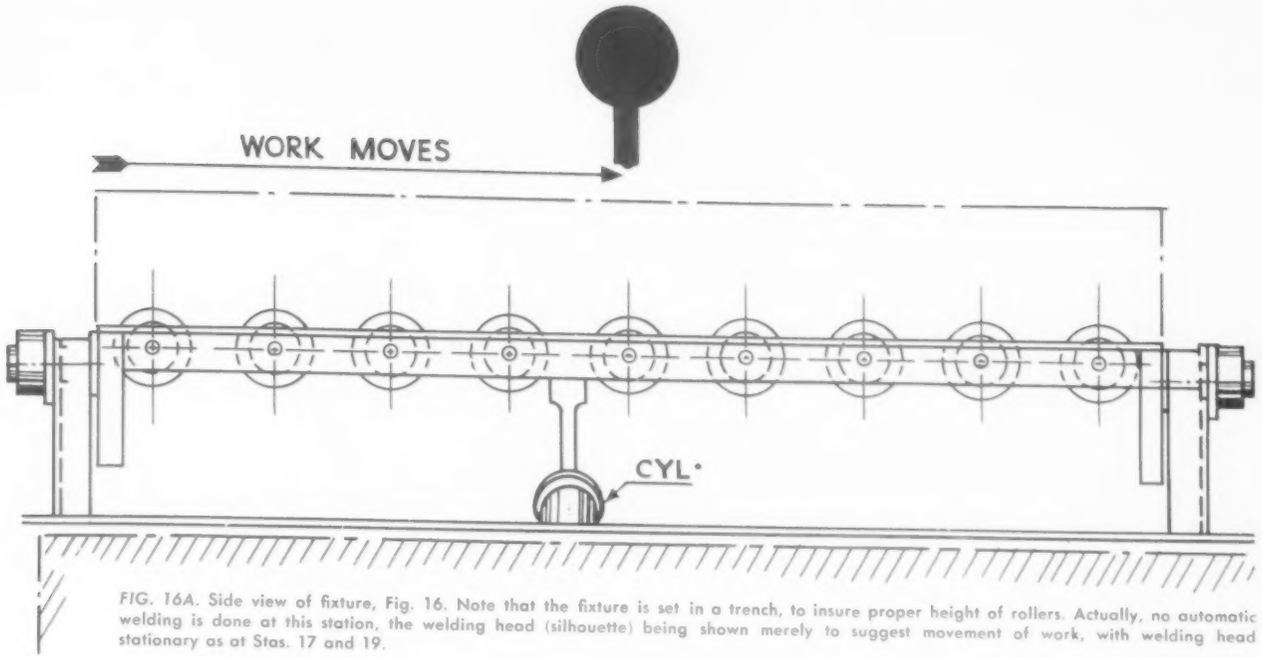


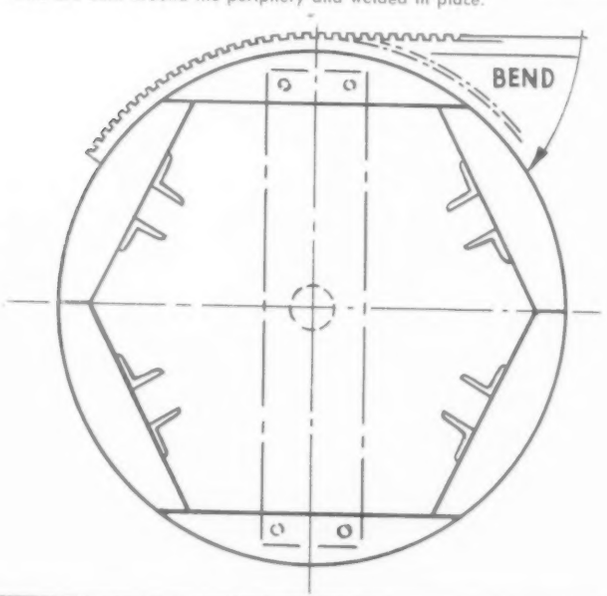
FIG. 16A. Side view of fixture, Fig. 16. Note that the fixture is set in a trench, to insure proper height of rollers. Actually, no automatic welding is done at this station, the welding head (silhouette) being shown merely to suggest movement of work, with welding head stationary as at Stas. 17 and 19.

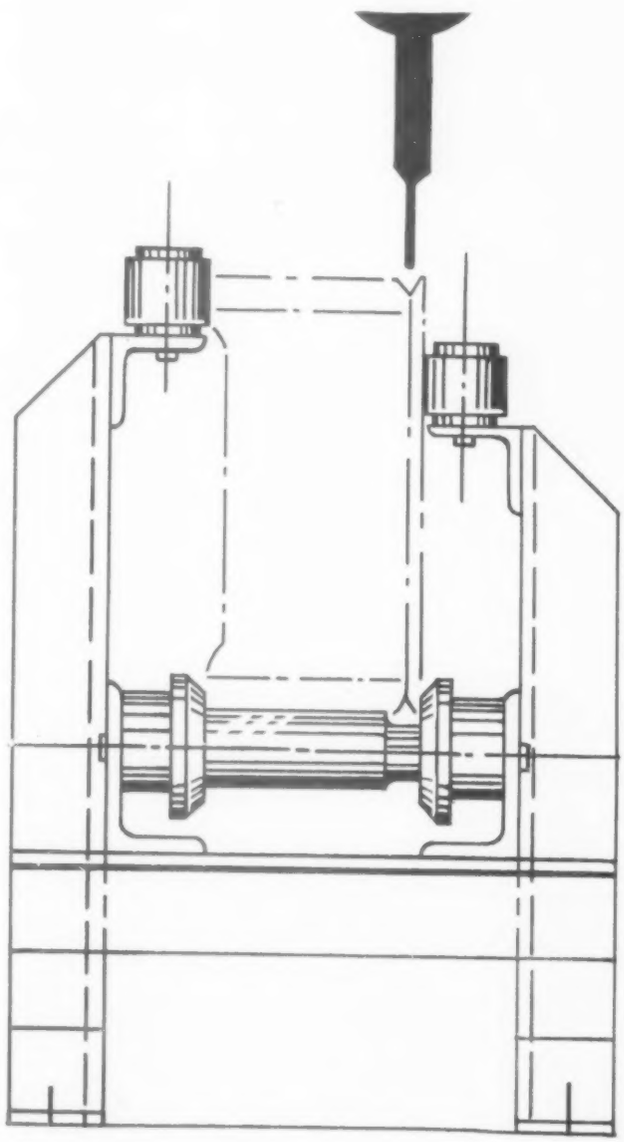
FIG. 17, at right. An alternate fixture, to be used in case V-joints should be at sides instead of at bottom.

tageous for balance and angles of positioning. In fact, no simpler means for "hooking" these parts can be suggested.

This concludes discussion of "Case Study No. 1," with its straight line flow and incidental fixtures and means for materials handling. There has, of course, been considerable repetition from the preceding installment; however, such "padding" was deemed necessary in view of the many illustrations and, also, because it enables the reader to more closely follow the operation sequences without referring to the preceding installment.

FIG. 18, below, shows method of fabricating end ring members, and gear, from plate segments. The O.D.'s may be cut to a true circle by mounting the assemblies on a stub shaft and rotating at the proper speed for cutting by oxygraph. Instead of cutting gear teeth, stock racks are bent around the periphery and welded in place.





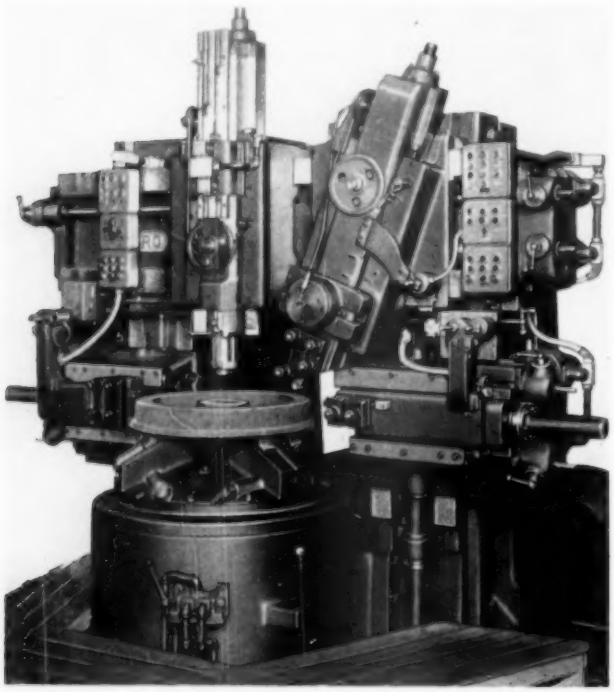
End of Part 2, this series. The 3rd and concluding installment, which will follow in February issue *The Tool Engineer*, will deal with Case Study No. 2.

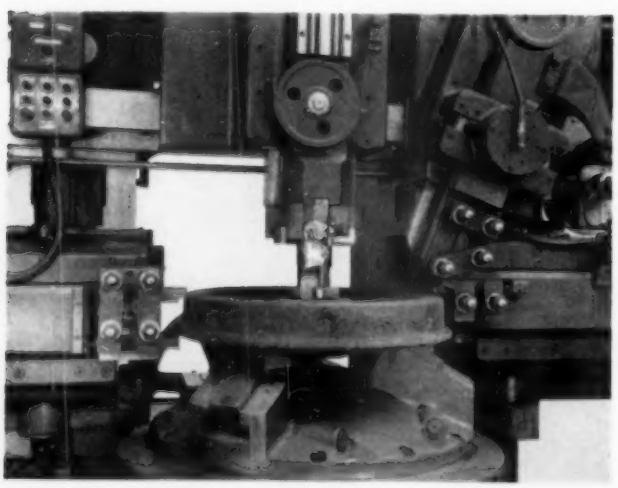
By Fred W. Steiner

Reviews and Previews

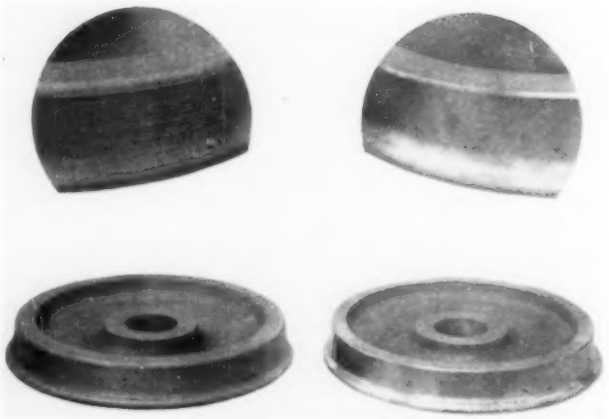
AMONG THE MANY NEW cost cutting tools, now available to industry, is the Cincinnati Hypro Automatic Boring and Turning Mill for machining rolled steel car wheels. A product of the Cincinnati Planer Company, Oakley, Cincinnati, Ohio—long a leading manufacturer of double housing and open side planers—this machine is a postwar development that promises to revolutionize previous methods and practices.

A new and novel chucking arrangement not only centers the wheel perfectly, but holds it so that the hole may be bored simultaneously with the turning and facing of the rim, flange and thread. This feature results in superior finish, accuracy, and perfect rim balance, with longer life and less wheel maintenance. A single, central lever operates the chuck jaws, thereby reducing chucking time to a point where production is at the rate of six finished wheels per hour.





Above, a right hand front view of the Cincinnati Hypro Automatic Car Wheel Boring Mill. Below, a rough wheel in place on the unique 3-jaw chuck, with tools in starting position.



Wheels finished by the old plunge cut method, at left; and, at right, the high finish obtained by the new generated cut.

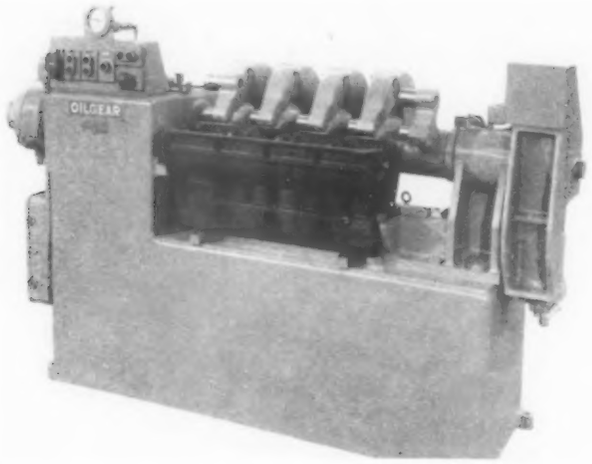
The machine is fully automatic. The operator picks up the wheel with a hoist, mounted on top of the machine, and lowers it until it rests on the chuck seats. He then moves a lever which operates the hydraulic mechanism, when the chuck closes and locks the wheel securely to the table. On pressing a button, the four heads—boring and facing, rim turning and the two side heads—all rapid traverse into the work. The heads then go into feed change, perform their operations and return to starting position.

The boring and rim turning heads, which are screw operated, are equipped with thymatrol motors and electronically controlled. Both side heads are equipped with General Electric contouring attachments to provide the taper and contour on the tread and flange of the wheel. Traverse and feed motion, to all heads, are effected by electronically controlled motors mounted individually on the heads—in fact, the entire operation of the machine is electronically controlled.

Carbide tools, with high negative rakes, are used for all turning operations, while the tools used in the boring and facing heads are of high speed steel. As all cuts are generated, this combination of tools not only closely approximates the correct surface speeds, but provides a greater accuracy with enhanced surface finish. The machine shown is designed to take wheels from 33" to 40½" inclusively; however, a machine for other diameters can be furnished.

ALSO AMONG THE NEW is a Cam Shaft Bushing Assembling Press, by the Oilgear Company, 1301-1417 W. Bruce St., Milwaukee 4, Wis., here shown set up to assemble five different size bushings in an eight cylinder engine block. Like the Hypro Mill just described, this machine is designed for operator convenience and push button control and impresses the observer with its well considered engineering.

Semi-automatic, interlocked, electric-hydraulic control provides alternative manual push button or automatic operation, as desired, with variable pressing and return speeds. The operator is not even required to turn, lower or raise the horn type assembling bar, nor to operate the cycle control levers.



Front view of 15 ton Oilgear Cam Shaft Bushing Assembling Press, with eight cylinder engine block in position. The horns of the bushing bar are shown raised.

Semi-automatic operation is selected by pressing a single push button. However, the electric-hydraulic control is so interlocked that the bushing bar is not rotated into assembling position, nor pulled inward to press home the bushings, until the operator has placed the bushings on the pins and guided the engine block into approximate assembling position on the press.

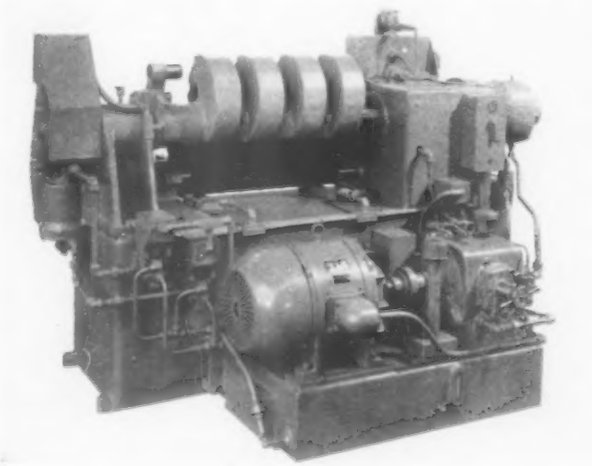
At this point, and without pressing any buttons or further attention from the operator, the small hydraulic actuated plug automatically enters the end cam bushing hole to locate the block angularly. A hydraulically actuated rack and pinion then turns the bushing bar to lower the bushings in line with the cam shaft bearing holes, also, to align with large guide pins with the front and rear main bearing holes.

The main ram now pulls the bushing bar to accurately position the motor block on pins entering the main bearing holes as the several cam shaft bushings are pressed home. That done, the main ram pushes the bushing arm back, while the hydraulic actuated rack and pinion reverses to retract the bar and to raise the bushing horns. The automatic cycle is now completed, and the finished block is slid onto an outgoing conveyor and another block is slid into place. The cycle is automatically repeated.

Manual push button operation may be selected by pressing a single button, when lowering or raising the bushing bar, or pulling or pushing it. Pressing an emergency mushroom button stops the cycle at any point, while pressing a reset button returns the bushing arm to loading position.

As an indication of nicety of design, detents in the bushing pins accurately align the oil holes in the bushing with the oil holes in the motor block, while a direct reading gage indicates the pressure and force required to assemble the bushings. Hydraulic units are all Oilgear, and drive is through a 7½ hp electric motor.

Rear view of the Oilgear Cam Shaft Bushing Assembling Press. Passage of work is from front to back, at conveyor height with drive and hydraulic units all below table level.



IN A SOMEWHAT DIFFERENT yet essentially a new field is a machine for formed folding of sheet plastics, developed by Taber Instrument Corporation, 111 Goundry St., North Tonawanda, N. Y. This machine, which is announced by the Taber Plastics Equipment Division, marks an important postwar milestone in sheet plastics folding techniques. Of advanced design, it makes possible the folding of plastic sheeting, ranging from .005" to .020" in thickness, into a "U" type 180° fold with sides tight together.

Known as the "Thermafold" Plastic Folding Machine, the new unit provides a controlled folding cycle which enables the average operator to turn out seven hundred "formed folds" per hour. This production rate, incidentally, can be considerably stepped up whenever folding in multiples is entirely practical.

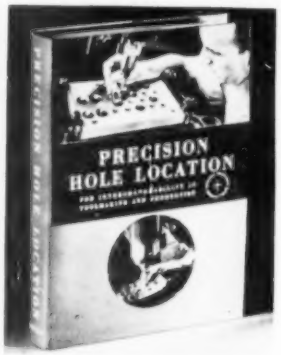
The formed fold is accomplished by means of thermostatically controlled heat. Heat is necessary since forming a fold in plastics is analogous to molding the material into the particular shape or fold desired. Hence, the machine eliminates such inherent faults in forming as tearing, cracking or opening up when creased or bent as in previous practice. Furthermore, the machine is fully adjustable to accommodate all types of thermoplastic sheeting.

In keeping with traditional Taber engineering standards, the machine is precision designed and built. The unit is hand fed and foot operated; however, the actual fold cycle is automatically controlled to insure trouble-free performance. A combination of aluminum and fabricated steel, in its construction, provides lightness with strength, while the flowing lines insure cleanliness and easy manipulation. Heat control is automatic, and effortless operation eliminates the need for power drive, with its extra expense and maintenance costs.

The "Thermafold" Plastic Folding Machine, by Taber Instrument Corporation, North Tonawanda, New York.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press



PRECISION HOLE LOCATION FOR INTERCHANGEABILITY IN TOOLMAKING & PRODUCTION, a 448-page handbook published by *Moore Special Tool Company*, Bridgeport, Conn., aims to help toolmakers accurately mass-produce special tools, dies, fixtures, gages and molds.

J. Robert Moore, the author, has included 184 pages of tables prepared by W. J. Woodworth and son, for laying out holes in circles. Calculated in rectangular coordinates for circles divided into 3 holes up to and including 100, these tables should enable jig borer operators to obtain correct figures with the least possible effort. The introduction is written by Guy Hubbard, Machine Tool Editor, "Steel" magazine. The text is priced at $3.00 within the U. S. metalworking industry; $3.50 elsewhere.

CHARACTERISTICS OF KENNAMETAL, a 16-page booklet available from *Kennametal, Inc.*, Latrobe, Pa., details results of eight years of research and development of its compositions which primarily consist of two general classes: tungsten-titanium-carbide and tungsten-carbide. The booklet explains that Kennametal is "precisely controlled throughout every stage of its manufacture by means of scientific instruments in the hands of skilled technicians, according to advanced methods of powder metallurgy." Users of tools know Kennametal for its high degree of hardness, strength, and resistance to wear. It has gained general acceptance for use both in single point lathe and boring tools, and in milling cutters.

Available from DoALL's Minneapolis Div'n, is a **VOLUME I INSTRUCTION PROGRAM,** compiled for use as a text in contour sawing instructional programs in school and factory. One section of this two-part book covers conventional, the other high speed sawing procedures, including work projects and tests to be given trainees.

The material in Volume I is substantially the same as was used with such outstanding success by the army and air corps during the war. Full particulars of this new contour sawing training program can be obtained from *The DoALL Company, Minneapolis Div'n*, 1301 Washington Ave., South, Minneapolis 4, Minnesota.

FABRICATING SHEET METAL PARTS OF JET ENGINES, by Harold A. Knight, in December *Materials & Methods*, tells the story of welding processes used by the I-T-E Circuit Breaker Co., Philadelphia, in fabricating sheet metal parts for jet engines.

One of the problems involved, explains the author, was the fact that no fluxes could be used since most of such fluxes contained fluoride which eventually might cause failure in the areas adjacent to welds. The article tells how different types of welding, including resistance seam, atomic hydrogen, resistance spot, and electric arc welding were used to effect a solution.

A USER LOOKS AT HYDRAULICS, by H. T. Johnson, Director, Facilities & Equipment Process & Development Section, General Motors Corp'n, in December 16th issue of *Steel*, is a plea for closer cooperation between manufacturer and user of hydraulically operated or controlled equipment.

Speaking for his concern, which is currently using over 100,000 metal cutting tools and presses, he states, "All of our plants are greatly disturbed regarding the inaccessibility of pumps, valves, piping, etc., in present machine tools." His suggestions for improvement include mounting hydraulic controls, pumps and reservoir alongside the machine, on the floor if need be, to insure accessibility.

The author further believes that more attention ought to be given to reducing oil leakage; and, that better schematic circuit diagrams should be prepared by manufacturers to assist users in reducing down-time, when hydraulic trouble shooting. Concluding, the writer states that no matter what the operation and control of a machine may be—hydraulic, electrical, mechanical, or a combination of any of these—". . . they will continue to be used where each fits best. Improvements are constantly being made in all methods."

HOW TO CREATE JOBS IN A FREE ECONOMY, a speech by Joseph L. Trecker, released in booklet form by *Nat'l Machine Tool Builders' Ass'n*, 10525 Carnegie Ave., Cleveland 6, is a discussion of ideologies, good and bad. Mr. Trecker also develops a practical ideology based on the premise that operation of the competitive system, with volume productivity, must lead to the creation of jobs for all. He believes that management should be more vigilant in passing this basic ideology along to all employees.

"In my opinion," states Mr. Trecker, "it is the failure of industry to educate the public to an understanding of the basic economics behind the volume production principle that has led to much of our present social unrest."

DESIGN CONSIDERATIONS FOR WELDED MACHINERY PARTS, by George L. Snyder, in December *Machine Tool Blue Book*, deals with two production methods for weldment fabrication: (1) From the standpoint of "universal" equipment, such as positioners; and (2) from the special jigs and fixtures' viewpoint.

This article, Part II of a series, discusses welding subassemblies, intersections, shrinkage and warpage, conditioning and inspection methods, as well as specifications. The author concludes by cautioning that, "Often a relatively close tolerance of welding, at some point in a weldment can be costly to achieve. Proper study might show that the tolerance can be loosened without affecting the service performance of the weldment."

LOW PRODUCTION IN BRITAIN BRINGS SOCIALISM, by A. Wyn Williams in December *Machinery*, pictures low productivity in Britain as caused chiefly by the policy of trade unions which has been to obstruct introduction of modern machines and techniques.

The author gives examples of low productivity, including the British pottery industry where a worker turns out 100 dozen small plates a day as against nearly 300 dozen by the American worker. He also points out that in the British textile industry there has been little advance in 40 years; and, in British coal mining, the overall output per man shift is today no higher than 30 years ago.

Drilling and Boring Tools

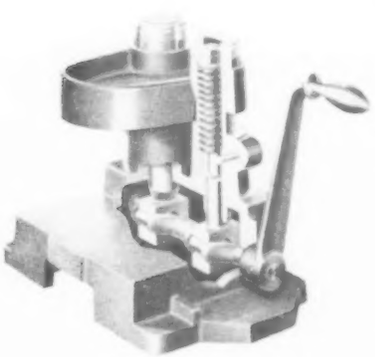
Installment No. 6 of a Series

HAVING DISCUSSED DRILLS and bushings in the previous installments, we will now take up jig and fixture design. Since, however, drill jigs range from simple templates and wooden "crickets" to fully automatic fixtures that, to all practical purposes are machines in themselves, this discussion will run into several installments. Considering the wide variety of design and construction, a general coverage in any one installment would be too superficial to be of practical value. Hence, we'll "spread it out."

Just as bushings have been standardized over a period of years, so drilling fixtures have become standardized and widely accepted throughout industry. The most commonly used standard fixture is the so-called "pump jig," such as manufactured by the Siewek Tool Company, Detroit, and the Swartz Tool Products Company, also of Detroit, among other makers.

These fixtures are superficially similar, and also somewhat similar in principle, in that they employ springs or cam locks to clamp the work between a stationary base and a movable bushing plate. With the springs, tension is sufficient to securely clamp the work and to withstand any load for which the fixture is designed. A spring type jig of Siewek design is shown in Fig. 1. Note that the springs are housed inside the guide pins; and that pressure is exerted against a crank which, on being rotated slightly past top dead center, holds the jig open for loading. Fig. 2 shows a Siewek "Junior" spring jig, with engineering dimensions and data.

Fig. 3 shows a standard L Type Swartz fixture, here set up to drill the flange holes in engine manifolds. Note the fixture lock at right, in the base.



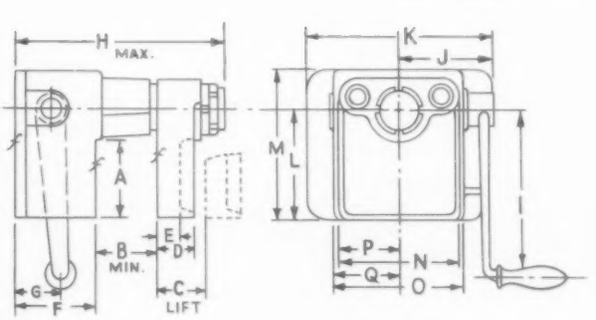


FIG. 1, left, Siewek Spring Type Jig. *FIG. 2*, below, Siewek Type "A" Junior Spring Jig, with engineering dimensions. Illustrations by courtesy of Siewek Tool Co., 2862 E. Grand Blvd., Detroit 2.

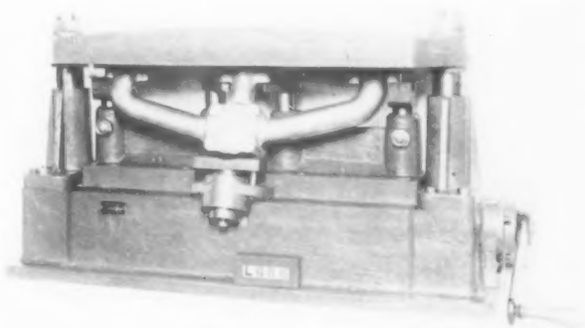
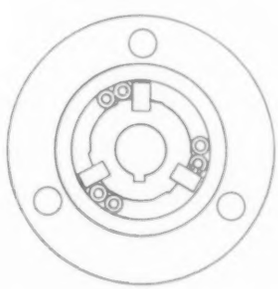


FIG. 3. Standard L Type Swartz Fixture, set up to drill flanges in engine manifold.

This lock is of the overrunning clutch type, so designed that when rotated in one direction, it securely resists all ordinary forces which may tend to release it. However, it is readily released by a slight jolt on the handle.

Fig. 5 shows a Swartz jig with upper and lower pilots; and Fig. 6 is a Swartz fixture designed for lateral indexing, to drill and ream. Standard types of bushing plates—full tray, half tray, plain drill and plate—are shown in Figs. 7, 8, 9 and 10; while Fig. 11 shows a Swartz Type L fixture with engineering dimensions and data.

Use of standard fixtures does not preclude design since, for each job, the fixture may have to be slightly modified.



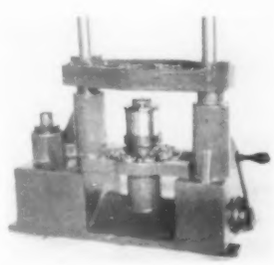
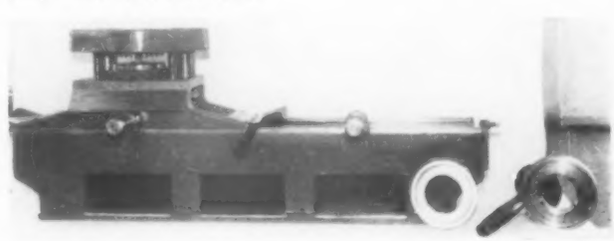
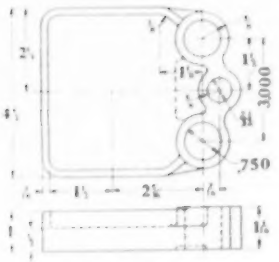


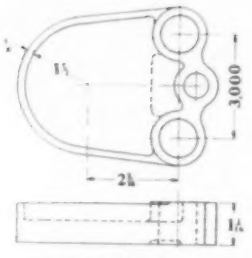
FIG. 4, left above, the Swartz fixture lock. *FIG. 5*, right above, Swartz pump jig with upper and lower pilots. *FIG. 6*, below, Swartz fixture for lateral indexing, to drill and ream under 2-spindle drill press provided with multi-drill heads. Photos by courtesy of Swartz Tool Products Company, 13330 Foley St., Detroit.





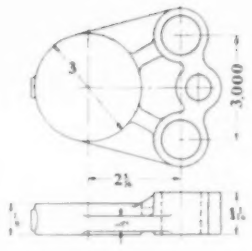
FULL TRAY

FIG. 7.



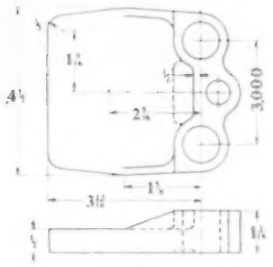
HALF TRAY

FIG. 8.



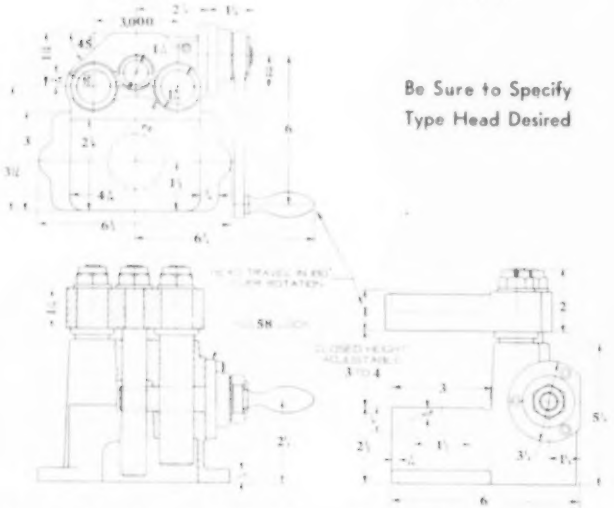
PLAIN DRILL

FIG. 9.



PLATE

FIG. 10.



Be Sure to Specify Type Head Desired

Guide pin centers will remain standard so that the bushing plates may be interchanged; hence, the fixtures may be used on a wide variety of work.

Locators and auxiliary clamps, where these are required, are usually installed in the base, although locators and guiding fingers may also be incorporated in the bushing plate. Catalogs, issued by the makers of these fixtures, contain all necessary engineering dimensions and data, and as these fixtures have become "musts" in the economy of tool engineering, it is recommended that the catalogs be on file in all engineering offices.

Also, among standard fixtures, are the box type jigs of which the Drillet, by Chicago Drillet Corporation, is a typical example. These jigs are of the assembled leaf type, and are available in some 150 different styles and sizes. One feature is that they may be used on all six sides, thereby

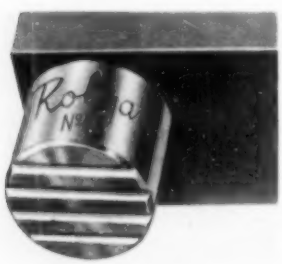
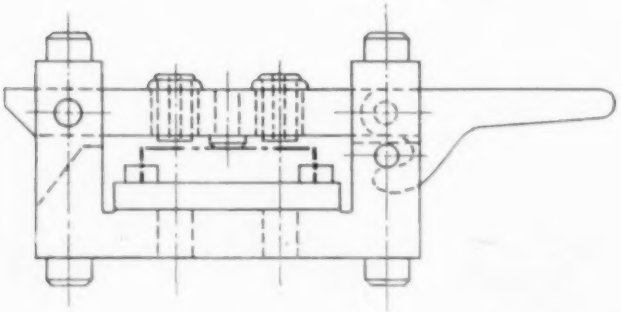


FIG. 13, left, standardized jig legs and bottoms, manufactured by the Rolyan Metal Products, 2330 W. 58th St., Chicago. *FIG. 14,* below, shows a typical cam lock type leaf jig with legs installed.

FIG. 15, at right, jig and fixture components manufactured by Morton Machine Works, 2422 Wolcott St., Ferndale, Michigan.



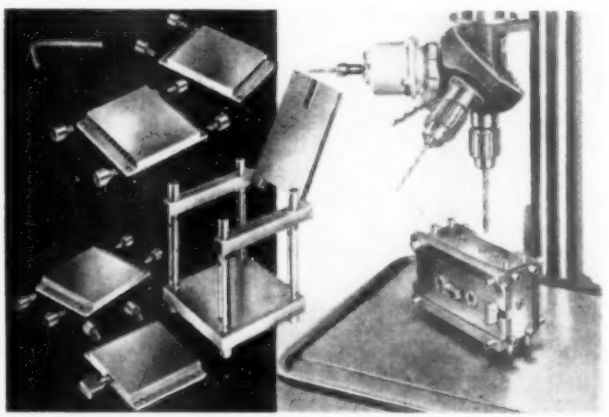


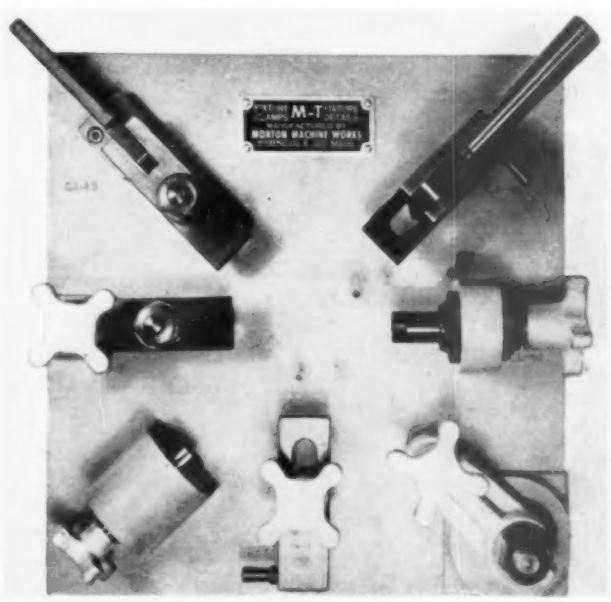
FIG. 11, left, above, Swartz Type L Fixture with engineering dimensions. *FIG. 12,* right, above, The Drillet box type Drill Jig, manufactured by Chicago Drillet Corp'n, 928 So. Michigan Ave., Chicago.

greatly widening their range of application. See Fig. 12.

Also standardized are jig components, as legs and rest buttons (see Figs. 13 and 14) and hand knobs, clamps, fittings, jack locks and toggle clamps. The latter, manufactured by Detroit Stamping Company (De-Sta-Co) are not shown here. The legs shown in Fig. 14, and pictured installed in a typical leaf jig in Fig. 14, are by Rolyan Metal Products, Chicago.

Shown in Fig. 15 are standard jig components manufactured by Morton Machine Works, Ferndale, Michigan; however, a wide variety of these components may also be had from Siewek Tool Company, Detroit, referred to above.

End of Part 6. Installment No. 7, this series, will follow in the February issue. The Tool Engineer.



GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Removing Stub Shafts

IT SOMETIMES HAPPENS, and usually at very inopportune times, that stub shafts break off close to shoulders, in blind holes, and defy all ordinary means to remove them. This is especially true in the case of machine spindles and crankshafts, when it might be necessary to dismantle the shaft and bore out the broken stub in a lathe. Such procedure is time consuming and expensive, in addition to time lost from production.

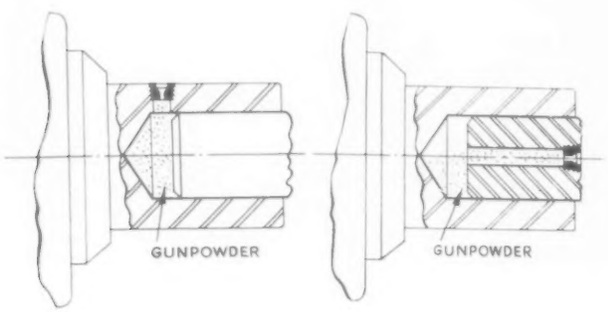
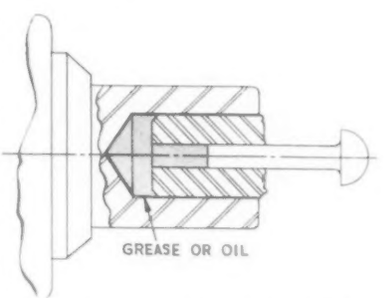


FIG. 1, above; Fig. 2, right, above; FIG. 3, right.



However, such parts can easily be removed "on the spot." If one knows the exact length of the shaft, in the hole, a hole can be drilled at right angles to the shaft, and just beyond the end of the stub, as shown in Fig. 1. Tap the drilled hole with a pipe tap, and insert a steel plug which has a smaller hole drilled in it.

Pour gunpowder through the hole in the spindle and plug it with the pipe plug. Next, pour a little powder on the plug, which should preferably be of the socket type. Then, touch off the priming powder and bang!—the broken part comes out like that!

If the length of the stub is not known, then drill a hole lengthwise, as shown in Fig. 2. Ram in the powder with a wooden stick, plug up the end as in Fig. 1, and proceed as before. As a precaution against possible accident, a sandbag can be disposed to catch the part as it is ejected.

Another method, but somewhat slower, is shown in Fig. 3. In this case, the hole is reamed for a close fit for a piece of drill rod, which should be quite small in proportion to the diameter of the broken stub. Fill the hole with grease, ramming it in until it almost fills the cavity. Insert the drill rod plug and hit it with a sledge hammer. Repeated blows should drive the part out; however, it will be necessary to add grease as the part is gradually forced out.

If the depth of the hole is known, a hole can be reamed at right angles, as suggested in Fig. 1, when a heavy oil can be used instead of grease. In either event, a very close fit between the reamed hole and the drift is necessary, else the "hydraulic fluid" will leak out.

Contributed.

Simple Draw Tool

WHEN HOLES (A) are to be tapped in thin sheet stock (Fig. 1), as for electrical contacts and similar parts, it is customary to first punch a small hole (as "d" in Fig. 2) and then to draw the stock out to the nominal tap drill size. As such parts are usually mass produced, the tools are mounted in a punch press, with punch and die accurately aligned. By this method, one obtains several threads instead of the single or fractional thread which would be the limit in the stock thickness.

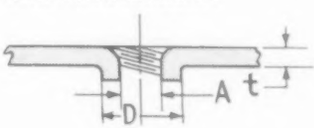


FIG. 1, above.
FIG. 3, below.

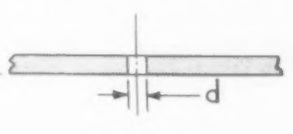
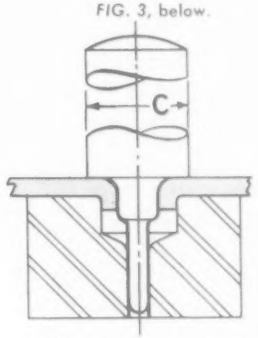
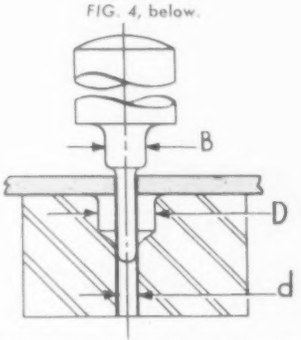


FIG. 2, above.
FIG. 4, below.





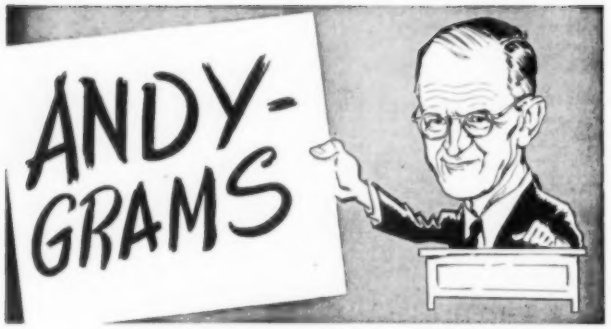
Often, however, it is desired to tap just a few holes in one or several parts used for tools or experimental models, when a simple, inexpensive draw tool, such as shown in Figs. 3 and 4, will serve. Taking a 10-24 tapped hole in 18 ga. stock as an example, the hole should be drawn to .150" very nearly, approximating a No. 25 drill. The O.D., or major die diameter (D) would then be .150" plus twice the stock thickness, (t) or .246". Diameter B, in the punch, would be .150", and the pilot diameter (d) could be 3/32". The punch shank should be slightly larger than diameter D, to act as a stop.

To use the tool, it is only necessary to thread the pilot through the small hole in the stock and to insert it in the pilot hole in the die. Punch and die are now aligned, and the draw is made by hitting the punch a few blows with a hammer.

C. J. Mogford
Davis Tool & Eng'g Co.
Detroit, Mich.

K-M Tools for Precision Boring

KENNAMETAL, INC., Latrobe, Pa., now offers a line of solid Kennametal squares, designated Style SS, for precision boring of steel, cast iron, and non-ferrous metals. These squares are supplied bottom side diamond ground, with 10° formed angle on one end, and may be ground to any desired tool point shape. Style SS tools are available from stock in K-M Grade K5H for precision boring of steel parts, and K-M Grade K6 for machining cast iron. Catalog sizes are: 3/16" or 1/4" square x 1 1/4" long; 5/16" square x 1 1/2" long; 3/8" square x 1 3/4" long.



USUALLY, I'm all in a lather getting the Column started, so this time I'm going to begin at the end and work backward, by token of which I'm already in the swim. My last stint, before putting the book to bed, was a trek to Madison, Wisconsin where, at the chartering of Madison Chapter, I found myself at the head table with the Society brass hats. They'd made me speaker!

Fred Kessenich, Ch'man elect, and 1st V.C. Larry Leifert were to have met me at the station, but I'd come up from Detroit with Harry Conrad, and when we got to Chi we found that we'd picked different roads for the final lap. So, we flipped a coin and I went Harry's way to another station, as a result of which Fred and Larry were left shivering in the cold. But not for long. They met Mae West instead! However, we finally got together, and so to the meeting, where only a few empty chairs gave hint of the presence, in town, of the Queen of Oomph. What bothered the previous speakers the most was a party, next door, having a high time singing "the old gray mare" and such.

1st Vice Prex Brad Peirce outlined the aims of the Society and installed the officers—Fred Kessenich, Larry Leifert, Ned Sperry, Bob Bruce and J. J. Pickarski—Ch'man, 1st and 2nd V.C., Sec'y, and Treas. in the order named. Then, there were congratulations and complimentary remarks by visiting Society officers—Harry Conrad, Bob Douglas (come all the way from Montreal) Larry Rademacher and Bob Ford from Milwaukee, Ed Dickett from Rockford and ambassadors of good will from Fond du Lac and points North, East, West, South. Oh, it was a gala event!

During my stay, Fred Kessenich took me for a tour through University of Wisconsin's Eng'g Department, all set up with an excellent machine shop and a fine gage lab among other things. As I've said before, Madison's a nice town, and my guess is that the boys of Madison Chapter are going to contribute materially to the progress of the Society. They're enthusiastic! One thing that impressed me particularly was the sponsoring, by Parker Pen Company, of transportation and expenses to meetings of members in their employ, and by Moe Brothers Manufacturing Company of memberships by their employees. My congratulations to both concerns who, in my belief, will draw good interest on their investment.

With Harry Conrad, I'd planned to take the 10:45 train next morning, but Brad Peirce talked us into taking the 8 o'clock instead. "We'll have breakfast on the train," sez he. Well, I woke up betimes, as usual, and went down for a cup o' Java, along with which I put down some pancakes and fixings. Then I took up a cup of coffee as a peace offering to Harry, who'd grumbled something scandalous just because I took to singing in the bathroom. Helluva note!

Anyway, we got on the train, and no diner! So, there the rest of 'em had the porter chasing out at every way station for coffee and buns, an' no soap nowhere. So, I entertained (?) 'em with tales of *smorgasbord* and the aromas of various brands of coffee until I had 'em drooling and Bob Douglas threatened to have me thrown off the train. No gratitude, nohow.

Between trains, in Chi, took a few hours passeur through the Field Museum, where I hobnobbed with my antediluvian ancestors, like the Neanderthal man and the *effete* Cro-Magnon. The former, who saw the decline of the dinosaurs, knew the use of fire, while the latter—a contemporary of the mammoth—was an artist of no mean ability. A worthwhile trip, all told, that enriched me in knowledge and a widening circle of friends.

Back on the job to find mail piled up, which I'll answer when I can, first reducing the backlog. I should 'a' been born twins! Among letters was one from Roger Waindle of Elgin Watch Sapphire Div'n, asking me up to see him sometime, which I was all set to do when I went to Peoria, only the RR boys pulled a strike and stymied my transportation. I'll be seeing you, Roger—soon's I can.

One thing that gave me both pleasure and a sense of futility a/c pressure of work precludes doing half the things I'd like to do, was a raft of Christmas cards from friends North, East, West and South. Thanks, everybody!—and the same to you. Me, I had to broadcast greetings through the December Column, which I hope you all took as a personal message. One card, from McReynold Die & Tool Company was really a beautiful book with stories of Christmas customs in various lands. The little story about *Lucia* (St. Lucy) of Sweden evoked poignant memories.

I recall the time when, as a tad, I went with my grandmother to bring coffee and cakes to a near neighbor, a mile or so away. The path led through a primeval forest, but what with the glistening white of the snow, and hoar frost that caught the reflection of the stars (they seemed so close overhead that one could almost hear them whisper) we walked as through a lighted fairyland. Grandmother, and the gentle old folks that we visited that morn have long since taken their places among the stars, but the memory—that lives in my heart.

Well, I've lots to tell, and not much space left in which to tell it. (Guess I'll have to write a book.) However, I want to tell you about a party Gust Headbloom of Apex Broach Company, Detroit, threw for the Swedish Engineers Society, to which I was invited along with our editorial associate, Fred Steiner. Of course, a lot of the S.E.S. members are ASTE'ers—several of 'em past Directors—so it's all in the family. Never saw such a feed in your life!—everything from smorgasbord to full course turkey, ham and rib roast dinners. And you had to take all three! Like the rest of the broaching concerns, Apex is developing new techniques, some of 'em revolutionary but at the moment confidential.

Also, managed to take in Detroit Chapter's Christmas party, at the Book Cadillac, attended by close to a thousand as near as I could judge. The floor show was one of the best I've seen in many a moon, and compared favorably with the best put on at our Nat'l conventions. Larry Rademacher was there, and I had opportunity to renew acquaintance with Fred Bush, formerly of St. Catharines but now domiciled in Detroit. Oh, it's nice to get together with the boys, by token of which I recommend that you all try to get to meetings oftener.

Well, that's about all for now, except to tell you that H. Q. is working hard, along with the Houston boys, for a bang-up Annual down Texas way come March. And that'll be right around the corner by the time you read this, so make your plans and get set to vacation in Houston.

ASTEely Yours,

Andy

A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Representatives of the National Program Committee, and the Host Chapter Committees, lay groundwork for the Society's convention in Houston, March 19-22, during meeting December 6-7 at the Rice Hotel in that city. Standing, left to right: E. W. Baumgardner, D. C. Crowley, Stephen Urban, J. A. Daar, R. W. Ford, H. E. Conrad, P. E. Brainard, G. J. Gilbert, R. E. Schuller, T. J. Gilchrist, I. W. Barker and C. A. Vogt. Seated: J. D. Bailleres, C. E. Barton, W. L. Clark, L. P. Robinson, F. E. Doty, Jr., Homer Briggs, D. E. Mackenzie and D. F. Saurenman. Meeting was one of three held by Program Com.

Industrialists to Highlight Houston Convention Sessions

Plant Tours, Rodeo, Barbecue, Ladies Program Scheduled for March 19-22 Meeting

TECHNICAL SESSIONS of a caliber seldom before presented at ASTE conventions are being planned by the National Program Committee for the Society's Annual Meeting at Houston, March 19-22. Tours of plants characteristic of the Southwest and thrilling entertainment which few ASTE members have witnessed in its native setting are being arranged by the Host Chapter Committees. Headquarters for the four-day event will be at the Rice Hotel.

Each technical session will be sponsored by a leading company in its field and will feature an industrialist as guest speaker.

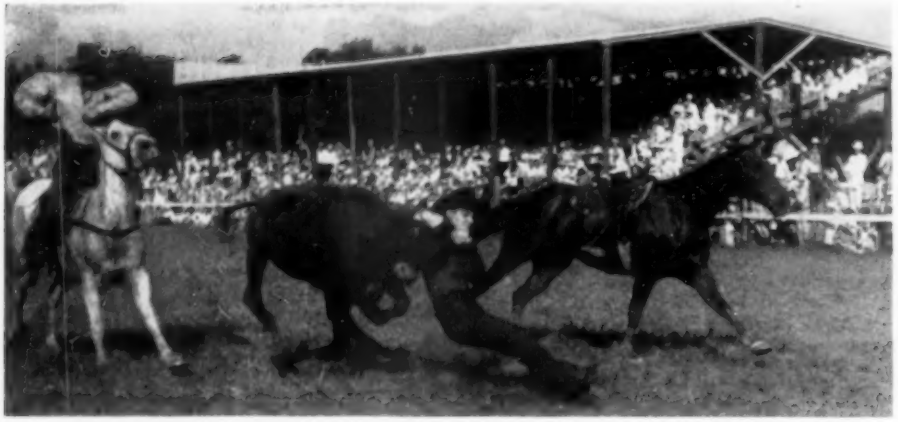
Keynoter for the opening meeting, "Crush and Diamond Dressing of Grinding Wheels," Wednesday afternoon, will be F. J. Tone, Jr., Vice-President of the Carborundum Co., Niagara Falls, N. Y. Mr. Tone will be followed by another speaker from his company in a discussion of the development and selection of grinding wheels. F. J. Schmitt is Chairman of the session.

E. V. Flanders, Chief Engineer, Thread Grinder Dept., Thread Tool Div., Jones & Lamson Machine Co., Springfield, Vt., will round out the symposium with a lecture on applications of the processes.

A tonic for ailing industry is the tentative offering for Wednesday evening when James F. Lincoln, President of the Lincoln Electric Co., Cleveland, Ohio, is scheduled to describe the successful application of "Incentive and Enterprise," with E. W. Baumgardner presiding.

The Lincoln system of wage incentives has so stimulated individual productivity

In This Issue



Texans don't believe in "all work and no play." At conclusion of formal convention program, Houston Chapter will entertain Society with breathtaking scenes like this at a professional rodeo on a nearby ranch

that the company was able to distribute 1946 year-end bonuses amounting to $2,800,000, with a minimum of $1500 per worker.

A subject brand new to ASTE audiences, but familiar to Texans, will be presented Thursday morning in "The Tool Engineer Looks at Oil." Harry C. Wiess, President, Humble Oil & Refining Co., Houston, Texas, and other executives from his company will unfold the story of oil production, stressing what the industry expects from the tool engineer. F. E. Doty, Jr., is in charge of this meeting.

Modern Materials Program

"Magnesium and Plastics," an interest compelling combination, is scheduled for Thursday afternoon with Stephen Urban as Chairman. A. P. Beutel, Vice-President and General Manager of the Texas Div., Dow Chemical Co., tentatively heads the session, supported by other Dow speakers.

Thursday evening a symposium, "Professional Tool Engineering," will be conducted by O. W. Winter, National Education Chairman. Mr. Winter tentatively expects to present a program similar to the one arranged for the postponed Pittsburgh convention.

Friday morning's technical audience will learn about "Super Precision Instrument Manufacture" from an executive of Schlumberger Oil Well Surveying Co. and Col. E. E. Drake, President of the Gulf Research Development Co. Homer Briggs and Dean Saurenman, Houston Chapter officers, will serve as Co-Chairmen.

Carbide Speakers

Noah Dietrich, Vice-President of Hughes Tool Co., Houston, will introduce a study of "Unusual Carbide Applications" to be sponsored by his company, Friday afternoon. H. E. Linsley is the presiding officer. Various phases of the machining of hard surfaces will be discussed by Philip McKenna, President of Kennametal, Inc., Latrobe, Pa., and speakers from Hughes Tool and Reed Roller Bit Co. of Houston.

The technical program comes to a close Friday evening with a session on "Valve and Meter Manufacture," featuring Col. W. S. Rockwell, Chairman of the Board of the Rockwell Manufacturing Co., as guest speaker. Technical lecturers at this meeting will describe high pressure and high temperature operating valves, machining and applications, as well as meter construction and manufacture. R. W. Ford will introduce the speakers.

* * *

Each morning a program of educational films, to be selected by H. D. Hall, National Program Chairman, will be presented.

Afternoon plant tours will begin Wednesday with a visit to Emsco Derrick & Equipment Co. Thursday, members will have an opportunity to inspect the plants of the Reed Roller Bit Co. and Hughes Tool Co., while on Friday there will be a trip to a nearby oil field to observe the operation of a drilling rig.

Important business meetings will be held by the House of Delegates, the Board of Directors and various committees. Delegates will convene Thursday morning to elect a new Board of Directors. In the afternoon, the incumbent Board will begin a meeting expected to continue on Friday.

National Officers to be elected by the Board will take the oath of office in a ceremony at the National Membership Meeting preceding the Friday evening technical session.

Representative groups of the various National Committees will confer at stated times during the three meeting days.

* * *

With the serious business of the convention out of the way, the Houston committee will take over on Saturday, "Texas Day," when ASTE members and their wives will be guests of the local Chapter at a real Texas rodeo and barbecue. This social event replaces the customary banquet. Busses will leave the headquarters hotel at 10:30 in the morning for the 20-mile trip to the 680-acre LH-7 ranch.

As David C. Crowley, Entertainment Chairman, describes it: "The beef is already ours. It is on the hoof at the ranch, and the way we are feeding those steers shouldn't happen to a pig. Ten days before the barbecue, in the cooler they go to age. Comes Friday night, into the barbecue pits they go over glowing post oak charcoal, along with the ranch beans; Saturday morning, in go the potatoes, and at noon the feast of your life."

Cowboy Show Climaxes Meeting

After gorging themselves on this mouth-watering fare, the ASTE guests will make their way to the nearby rodeo grandstand reserved for the Society. Colorfully attired professional rodeo riders will provide an exciting afternoon of trick roping, bulldogging, steer riding, bronc busting and calf branding. For those who do not get their fill during the three-hour exhibition of cowboy skill, the public rodeo continues the following day, playing to more than 10,000 spectators.

* * *

Ladies who attend the convention will also sample the Texas brand of hospitality in a program of events being arranged especially for them. One of the highlights will be a trip along the "Azalea Trail" with a visit to two private estates, while the display of the flowering shrub is at its height.

A bridge parlor will be available at all times in the headquarters hotel. Wives of Houston members will act as hostesses to the visiting ladies during their stay in the southwestern metropolis.

Hotel reservations will be handled by the Houston committee to assure assignment of rooms on an equitable basis. The Reservations Committee is emphatic in urging that accommodations be requested at once on forms furnished by the Central Office and sent directly to Houston.

Travel arrangements, too, must be made well in advance. Members plan-

Houston, '47 Annual Meeting city, is a bustling metropolis of 600,000, with an ever-changing skyline of modern buildings. Beyond city's periphery stretch the limitless plains of the nation's largest state

ning to use the special train leaving Chicago and St. Louis on Tuesday, March 18, and arriving at Houston the following morning, should notify the Central Office immediately. Chartering of the train is contingent upon a guarantee of 200 reservations. Details concerning this train were announced in the December *Tool Engineer*.

A small, all-inclusive registration fee of $2.00 admits an ASTE member and his wife to all technical sessions, plant tours and the rodeo and barbecue. Nonmembers will pay a $4.00 fee to participate in the technical sessions and plant tours.

Between times, visitors will explore amazing Houston, the oil center and leading spot cotton market of the world, its busy port, fine stores, beautiful parks and residential districts, year-round facilities for golf, fishing and other sports, extensive and varied agricultural activities, and livestock raising.

Attractive Sidetrips

Winter-ridden Northerners can scarcely resist the temptation to slip over to Galveston for a dip in the warm waters of the Gulf; to make a leisurely return trip with an excursion into old Mexico, stopovers at other points in Texas or romantic New Orleans.

Plans for the 1947 Annual Meeting were developed by the National Program Committee in a series of meetings at Buffalo, Houston and Detroit. At the Houston conference, the Host Chapter Committee presented its schedule of local activities.

Members of the National Program Committee working on the Texas meeting, in addition to H. D. Hall, Chairman, are: Stephen Urban, E. W. Baumgardner, F. J. Schmitt, F. E. Doty, Jr., H. E. Linsley, and R. W. Ford.

Houston Chapter Committeemen are: Executive, J. C. Preston, H. E. Collins and L. M. Krause; Program, Homer Briggs; Registration, L. P. Robinson; Reservations, William L. Clark; Meeting Arrangements, Paul E. Brainard and John D. Bailleres; Entertainment, David C. Crowley; Transportation, Dean F. Saurenman; Plant Visitation, L. M. Cole and Hoyt Turner; Budget, T. J. Gilchrist and H. C. Boswell; Films, Don Mackenzie and C. E. Barton; Notices and Announcements, A. F. Miller, Jr., and Chris A. Vogt; Editorial, Bob Schuler and I. W. Barker; and Emergency, James A. Daar and George J. Gilbert.

More complete details, as developed by the Program Committee, will be announced in the February convention issue of *The Tool Engineer*.

Koch Acquires Firm

Detroit, Mich. — George T. Koch, President of Engineering Service, Inc., has recently acquired sole ownership of the firm.

G. T. Koch

A Registered Professional Engineer, Mr. Koch is a member of ASTE, ASIE, the Engineering Society of Detroit, National Association of Engineering Companies and the Michigan Society of Professional Engineers.

In his plant he sponsors a refresher course, instructed by Prof. John J. Uicker of the University of Detroit, to assist engineers in preparing for examination for professional registration.

LETTERS *from the President*

NO. 3, YOUR CENTRAL OFFICE AND ITS PLACE IN THE SOCIETY

Fellow Members:

In my last message to you, I spoke of the work of your National Officers and National Committee Chairmen. Now, I would like to direct your attention to the work of the Central Office and its place in the Society structure.

The National Directors formulate broad general Society policies; your National Officers, together with your National Committee Chairmen, translate these into terms of concrete plans and specific policies, and supervise their execution.

The Central Office in Detroit, headed by your Executive Secretary, and staffed by 20 other employees, carries out most of the detail work and acts as a coordinating body. This Central Office is, in effect, very similar to the head office of any business concern, manufacturing a variety of products and providing a diversity of services, for 75 branches throughout this country and Canada.

By any and all standards, this is not small business. Few local officers have any conception of the problems attendant upon the administration of such a large organization, nor the volume of work processed by the ASTE office staff.

* * *

The average business is doing well when it runs from 300 to 350 open accounts. Our 75 Chapters, each with five officers and seven committees, alone make 900 open and active files. When to this are added your National Officers, Committees and Directors, the total is brought to nearly a thousand active files of officers and committeemen with whom we are in constant communication.

This does not take into account the 18,000 individual membership accounts which require invoicing, accounting, receipting and constant servicing for address changes, purchases of Society emblems, data sheet binders and membership certificates, and the handling of individual requests.

In a typical month, your staff handles 1762 incoming and 1808 outgoing letters; 316 address changes; 936 telephone calls; numerous inquiries for information or technical advice from members and companies, and conducts data research for National and Chapter Committees.

In addition, an average of 17,526 units of mail are handled and processed through our Shipping Department, which includes Standard Data Sheets, Code of Ethics, and membership cards, as well as broadsides to committees and members.

* * *

Activities of the Standards, Program, and Membership Committees each require the services of one full-time employee, plus facilities for processing the work generated by them, such as mimeographing, collating, mail handling, statistical data and filing.

During the past several months, there has been a daily average of 12 new member applications completely processed, including the necessary accounting department procedure and file setup.

Since the Annual Meeting in Cleveland last April, there have been 31 National Committee meetings which naturally involved considerable work by the Central Office staff in anticipation of and consequent to these meetings.

Much effort is also entailed in preparing for the Annual and Semi-Annual Meetings. Committee reports, budgets and programs for these meetings all represent considerable detail in preparation and presentation.

* * *

It is difficult to even imagine the work involved in staging the recent New Era Exposition. Aside from the usual tasks of obtaining facilities for the show, laying out and selling exhibit space, there were 22 tons of printed material procured for this Exposition. Perhaps a more comprehensive idea may be obtained from these statistics: 22,000 registrations (18 people required to handle); 53,000 attendance (door count); 30,000 sq. ft. of carpeting, 1200 davenports and 2400 chairs contracted for.

Enough electrical wiring and piping was used to wire and rough plumb six, seven-room houses. A staff of 185 people was employed in manning, setting up and maintaining the show.

This gives some idea of the load carried by your Central Office.

* * *

Last year a survey was made by an office management consultant, who prepared a report instrumental in bringing about many new efficiencies in our office routine. Installation of the latest office equipment is enabling us to compile and mail Chapter rosters by the 5th of each month. These show the exact account status of each member. Society financial statements are also distributed simultaneously.

New mailing services, available to Chapters desiring them, have resulted in substantial Chapter economies.

Actually, it is a matter for wonder that so much can be accomplished by so few. This is possible only because the members of our staff are devoted to the cause of the Society, give generously of their own time, are knit together by a marvelous *esprit de corps*, and are directed by able executives.

When you come to Detroit, visit your Society headquarters, meet the people who serve you, and inspect your office. I know you will be proud of it.

A. M. SARGENT, *President*
AMERICAN SOCIETY OF TOOL ENGINEERS

Retires from Hardinge

W. Hartford, Conn.—Ray H. Morris, until recently Vice-President of Hardinge Bros., Inc., Elmira, N. Y., has retired because of ill health.

R. H. Morris

Mr. Morris, who has been associated with his company for the past 14 years, plans an extended rest before taking up new activities which he has under consideration.

A tireless worker for the Society, he devoted himself unsparingly to its interests during his term as President in 1943-44, making several transcontinental tours of ASTE Chapters.

Now Chairman of the National Constitution and By-Laws Committee and a member of the Annual Nominating Committee, he has held a number of other offices nationally and in his home Chapter at Hartford.

Nominating Committee Submits Candidates for '47-'48 Directors

TWENTY-ONE candidates for 1947-48 ASTE Directors have been presented by the Annual Nominating Committee, for consideration by the membership and instruction of their Chapter Delegates.

The Committee, composed of L. G. Singer, Chairman, Ray H. Morris, A. M. Schmit, H. R. Wentzell and W. W. Young, was elected during the Semi-Annual Meeting of the Board of Directors in October.

In a communication to Chapter Chairmen, accompanying the slate of nominees, Mr. Singer calls attention to the Constitutional provision that: "Twenty or more Senior members of the Society entitled to vote may constitute themselves a Special Nominating Committee, with the same power as the Annual Nominating Committee."

During their January business meetings, Chapters will indicate directoral nominees preferred or empower their respective Delegates to exercise their own discretion. Delegates and Alternates to the House of Delegates and Chapter Officers will be elected in February.

Ten Directors are to be chosen when the House of Delegates holds its Annual Meeting at Houston in March. The retiring President becomes the eleventh member of the Board.

The qualified candidates, selected by Mr. Singer's committee, are:

C. V. BRINER—Mgr., Tool and Gage Div., Pipe Machinery Co., Cleveland, Ohio. Senior member since 1936. Charter member, Past Officer and Chm., Cleveland Chapter. Past 2nd V.-Pres., 1st V.-Pres., and Pres. Incumbent Director (6 years) and Chm., Natl. Public Relations Com.

* * *

KARL L. BUES—Consulting Mfg. Eng., San Francisco, Calif. Senior member since 1939. Charter member, Past Officer and Chm., Golden Gate Chapter. Former Western Area V.-Chm., Natl. Industrial Relations Com. Industrial executive and tool engineer since 1923. Member, California State Board of Education Apprentice Training Com. Instructor in tool engineering and production engineering at University of California. A regular contributor of technical articles to trade publications.

CHARLES B. COLE—Pres., Tool Equipment Sales Co., Chicago, Ill. Senior member since 1937. Past Officer and Chm., Chicago Chapter. Former and incumbent Director. Has held responsible industrial executive positions. Author of books on tool engineering and related subjects. Active in other professional, technical and civic associations.

* * *

HAROLD E. COLLINS—Chief Production Eng., Hughes Tool Co., Houston, Texas. Senior member since 1939. Charter member, Past Officer and Chm., Houston Chapter. Former Southern Area V.-Chm., Natl. Editorial Com. Incumbent Director. Industrial executive and tool engineer. Active in affairs of other technical societies.

* * *

WILLIAM A. DAWSON—Executive, F. F. Barber Machinery Co., Hamilton, Ont. Senior member since 1941. Charter member and first Chm., Hamilton Chapter. Former member, Natl. Editorial Com.; Past Director, and incumbent Asst. Secy.-Treas. (2nd term). Has held responsible industrial executive positions in plant management and tool engineering since 1930. Active in numerous professional, technical and civic organizations. Holds B.S. in M.E.

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EARLE W. DeBISSCHOP — Supt. of Methods, Graflex, Inc., Rochester, N. Y. Senior member since 1939. Past Officer and Chm., and incumbent Delegate, Rochester Chapter. Incumbent member, Natl. Constitution and By-Laws Com. Has held responsible industrial positions for many years. Active in numerous technical and civic associations, and pioneer instructor of tool engineering.

* * *

THOMAS J. DONOVAN, JR. — Pres., Donovan Co., Philadelphia, Pa. Senior member since 1938. Charter member and Past Chm., Philadelphia Chapter. Incumbent member, Natl. Constitution and By-Laws Com. Wide industrial and executive experience. Active in other technical associations.

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ROBERT B. DOUGLAS—Works Mgr., Turcott Div., Canadian Car & Foundry Co., Ltd., Montreal, Que. Senior member since 1942. Charter member, Past Officer and Chm., Montreal Chapter. Served as Canadian Area V.-Chm., Natl. Standards Com.; on Publications Com. and other special committees. Incumbent Director (2nd term), 3rd V.-Pres., member of Handbook Com., Chm., Honor Awards and Professional Engineering Coms. Industrial administrative executive and engineer since 1938. Active in numerous technical and professional associations. Holder of M.S. degree.

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WILLIS G. EHRHARDT—Managing partner of Ehrhardt Tool & Machine Co., St. Louis, Mo. Senior member since 1938. Charter member, Past Officer and Chm., and incumbent Delegate, St. Louis Chapter. Has held various responsible industrial positions. Incumbent Pres., Natl. Tool and Die Mfrs. Assn., and an active member of many other technical and civic associations.

* * *

VICTOR H. ERICSON—V.-Pres., Johnson, de Vou, Inc., Worcester, Mass. Senior member since 1939. Past Chm., Editorial Com., Worcester Chapter. Former New England Area V.-Chm., and Chm., Natl. Membership Com. (2 terms). Incumbent Natl. Treas. and member, Finance Com. Outstanding authority on grinding processes.

* * *

WILLIAM J. GAMBLE — Pres., W. J. Gamble Co., Buffalo, N. Y. Senior member since 1938. Past Officer and Chm., Buffalo-Niagara Frontier Chapter. Past Director and incumbent member, Natl. Public Relations Com. Industrial and production executive since 1911. Has served actively in executive positions in numerous nationally known technical and civic organizations.

* * *

IRWIN F. HOLLAND—Gen. Supt., Small Tool & Gage Dept., Pratt & Whitney, Div. Niles-Bement-Pond Co., W. Hartford, Conn. Senior member since 1936. Past Officer and Chm., Hartford Chapter. Former Chm., Natl. Editorial, Nominating, Constitution and By-Laws (3 terms), and Resolutions Coms. Member, former Organization Progress Com. Incumbent Director (3rd term) and 2nd V.-Pres. Industrial production executive since 1915. Active in various technical and professional societies.

C. V. Briner

K. L. Bues

C. B. Cole

H. E. Collins

W. A. Dawson

V. H. Ericson

W. J. Gamble

I. F. Holland

G. C. Johnson

T. P. Orchard

W. B. Peirce

GEORGE C. JOHNSON — Factory Mgr., W. F. & John Barnes Co., Rockford, Ill. Senior member since 1937. Charter member, Past Officer and Chm., Rockford Chapter. Former member, Natl. Membership Com., incumbent V.-Chm., Finance Com. and Natl. Secy. His experience covers several years of progressive responsibility as industrial executive.

* * *

THOMAS P. ORCHARD—Pres. and Gen. Mgr., American Tool Engineering Co., New York City. Senior member since 1938. Charter member and Past Entertainment Chm., N. New Jersey Chapter. Charter member, Past Officer and Chm., Greater New York Chapter. Incumbent Director (3rd term). Past 3rd V.-Pres. Industrial executive, tool engineer, and supervisor of student training since 1914.

* * *

W. B. PEIRCE—V.-Pres., Research and Development, Flannery Bolt Co., Bridgeville, Pa. Senior member since 1938. Past Officer and Chm., Pittsburgh Chapter. Former Chm., Natl. Membership Com. (2 terms); member, former Organization Progress Com.; Past 3rd V.-Pres. and 2nd V.-Pres., and incumbent 1st V.-Pres. and Director (4th term). Industrial executive holding top administrative positions since 1907. Director of various manufacturing plants. Active executive in numerous technical, professional and civic organizations.

* * *

MILBURN M. ROSS—Pres., Ross Engineering & Equipment Co., Wichita, Kan. Senior member since 1941. Charter member, Past Officer and Chm., Wichita Chapter. Incumbent member, Natl. Membership Com. Outstanding experience as aircraft, production and tool engineer, and designer. Active executive in various technical and civic organizations. * * *

ARTHUR F. SCHROEDER—Asst. Factory Mgr., Wisconsin Axle Div., Timken-Detroit Axle Co., Oshkosh, Wis. Senior member since 1941. Charter member, Past Officer and Chm., Fond du Lac Chapter. Wide experience in tool engineering and management. Active participating member and officer in several technical organizations.

* * *

HERBERT L. TIGGES — V.-Pres., Baker Bros., Inc., Toledo, Ohio. Senior member since 1936. Incumbent member, Natl. Editorial Com. Wide and varied experience in responsible industrial positions. Incumbent Director, NMTBA. Actively participates in numerous technical, professional and civic organizations.

* * *

HOWARD F. VOLZ—Sales Rep., C. H. Gosiger Machinery Co., Dayton, Ohio. Senior member since 1938. Past Officer and Chm., Columbus Chapter. Former Director, and incumbent Co-Chairman of Natl. Membership Com. Sales engineer, tool engineer and production executive since 1919.

* * *

HORACE R. WENTZELL — V.-Pres. and Works Mgr., Adams Engineering Die & Tool Co., Inc., South Bend, Ind. Senior member since 1939. Charter member, Past Officer and Chm., South Bend Chapter. Former Director, and incumbent member, Natl. Constitution and By-Laws Com. Pioneer tool engineer in the automotive industry and active member in other engineering and technical societies.

* * *

GRANT S. WILCOX, JR.—Asst. Master Mechanic, Plymouth Div., Chrysler Corp., Detroit. Senior member since 1937. Past Officer and Chm., Detroit Chapter. Past Chm., Sub-Com., Natl. Standards Com. Incumbent Director, and member, Natl. Standards Com. Industrial executive in tool engineering since 1939. Past V.-Chm. and incumbent Chm., Engineering Societies Affiliate Council, composed of 30 member organizations of the Engineering Society of Detroit. Holder of B.S. in M.E. Author of articles on aviation.

Receives Honorary Degree

Rolla, Mo.—James P. Gill, Vice-President of Vanadium-Alloys Steel Co., Latrobe, Pa., on November 6 received the honorary degree of Doctor of Engineering from the University of Missouri, at the 75th anniversary of the founding of the Missouri School of Mines and Metallurgy.

Mr. Gill gave the annual Campbell Memorial lecture before ASM in 1936, and in 1939 was elected President of that organization. He is the author of "Tool Steels," and co-author, with several members of his company's metallurgical department, of a more complete book with the same title, published in 1944.

Mr. Gill is affiliated with Pittsburgh Chapter, ASTE.

D.C.A.S. Alumni Assn. Opens Membership Drive

Detroit, Mich. — The Detroit College of Applied Science Alumni Association has launched a membership drive in an effort to locate men who formerly attended this school.

Founded by O. B. Jones who subsequently founded ASTE, D.C.A.S. was the first college in the United States to teach tool engineering. During the past 20 years, the school has trained approximately 6,000 tool engineers, designers, and draftsmen.

Today these men are scattered throughout industry, but, through changes of address, the Alumni has lost contact with many former students who will be interested in knowing that an Alumni Association has been formed, with beneficial activities planned for the future.

At a recent meeting of the Alumni Association's Board of Directors, the following officers were elected: President, E. C. Putnam, President of Putnam Tool Co.; First Vice-President, George Eglinton, President of Lincoln Park Industries, Inc.; Second Vice-President, John Haller, President of Michigan Powdered Metal Products Co. and the J. H. Tool & Machine Works.

Secretary, Frank Curtis, Chief Engineer of the Ultra Lap Machine Co.; Treasurer, Edward Beyma, President of Central States Engineering Corp.; and Chairman of Finance Committee, Fred Gollbach, President of Ace Tool and Die Co.

Messrs. Eglinton, Haller, Beyma and Gollbach are members of Detroit Chapter, ASTE.

Any alumnus of the school can secure information concerning application for membership from O. B. Jones, President, Detroit College of Applied Science, 1200 West Eight Mile Road, Ferndale 20, Mich.

Describes G.I. Stove

Wichita, Kans. — Speaking before 60 members and guests of Wichita Chapter at their meeting November 13 in Wolfe's Cafeteria, L. W. Miller, Sales Manager of the Small Appliance Div., The Coleman Co., Inc., told "The Story of Ernie Pyle's G.I. Stove." The Coleman Co., manufacturers of gas, oil and gasoline appliances, produced over 1,000,000 of these stoves during the war period.

A sound film, "The Miller That Uses Its Head," was shown through the courtesy of the Nichols-Morris Corp.

M. M. Ross, of the National Membership Committee, reported on the recent Semi-Annual ASTE Meeting in Detroit.

At the close of the meeting, the Chapter adjourned to attend the "Made in Wichita" exhibit in which over 700 items were displayed. The exhibit was sponsored by the Wichita Chamber of Commerce and the Wichita Manufacturers Club.

E. W. DeBisschop

T. J. Donovan, Jr.

R. B. Douglas

W. G. Ehrhardt

M. M. Ross

A. F. Schroeder

H. L. Tigges

H. F. Volz

H. R. Wentzell

G. S. Wilcox, Jr.

Display of silicone products was a feature of the program, "Silicones as New Engineering Materials," presented by Max H. Leavenworth of Dow Corning Corp., at meeting of Flint Chapter, November 21. From left to right are: L. H. Kitchen, Chm.; Mr. Leavenworth, N. F. Snyder, 1st V.-Chm.; and E. A. Reed, Technical Chm. Above: Guests at the meeting included a group of Flint Technical High School honor students and faculty. Left to right: Dennis Kring, Carrol Jaquette, Science Instructor; Ted Bennett, Dwane Wood, Kenneth Stanneck, Hilmer Olson, Principal; and C. L. Fanning, Education Chm. of the Chapter

Versatile Silicones Resist Heat and Moisture

Flint, Mich.—"Silicones as New Engineering Materials" was the subject of the November 21 technical session of Flint Chapter, held at General Motors Institute. Max H. Leavenworth, Technical Representative for Dow Corning Corp., Midland, Mich., explained and demonstrated to 75 members and guests the amazing versatility and many proven uses of silicones.

Silicones, Mr. Leavenworth said, are presently being used as high temperature electrical insulation, water-resisting surface treatments, anti-corona cable-filling compound, low-temperature lubricants, heat-resisting greases, glass polish, anti-foaming agents, diffusion pump fluids, and heat-stable rubber.

Useful as Insulation

In general, there are three interrelated types of silicone products—resins, liquids and rubber. Two basic properties are common to them all. One is great temperature stability; the other is water resistance.

The silicone resins possess properties sought for high temperature insulation. They can be applied as liquid to a fabric or fiber glass or asbestos, filling the interstices. When baked, they form a permanent impregnant that repels water and resists heat far better than organic varnishes.

Like the other basic types, silicone fluids are uncommonly temperature stable, the freezing and boiling points varying with the viscosity. One such fluid, with a viscosity almost equal to water, freezes at about 125°F below zero at atmospheric pressure. Yet it boils at 300 degrees. These fluids are used as lubricants, damping fluids, temperature baths, and heat-transfer fluids.

Temperature-Stable Rubbers

Silicone rubbers retain indefinitely their elasticity and resiliency at temperatures of 300°F, and can be used in some places where temperatures reach 500°F. They are not as yet a general substitute for natural or synthetic rubber and may never be. Deficient in tension, shear and abrasion, they are oil and moisture resistant and very useful in applications requiring a wide temperature range, the speaker concluded.

Mr. Leavenworth illustrated his talk with slides and displays of silicone products. After the lecture, Edward A. Reed, Technical Chairman for the meeting, led a very interesting question and answer period.

As the after-dinner speaker, Dr. Mark W. Bills, Flint Superintendent of Schools, discussed today's problems in public education, stressing the importance of public participation in these problems.

C. L. Fanning, Education Chairman, introduced Hilmer Olson, Principal of Flint Technical High School, and four of his best students who were guests of the Chapter for the dinner and meeting.

Smila Chairmans Project To Standardize Carbides

New York City—W. H. Smila, Chairman of the ASTE National Standards Committee, was recently appointed Chairman of the ASME sub-committee to handle the standardization of shapes and sizes of the most commonly used carbide blanks.

The appointment was made by Prof. O. W. Boston, during the carbide session of an ASME meeting on metal cutting data, standardization of carbides and marking of high speed steel tools for material identification purposes.

Prof. Boston, who heads the Department of Metal Processing at the University of Michigan, is Chairman of the Manuscript Review Committee for the "Tool Engineers' Handbook."

William Moreland, of the ASTE National Standards Committee and Data Sheet Sub-Committee, aiso was in New York City to attend the ASA Technical Committee meeting on the standardization of twist drills.

Standardization programs of the three organizations are expected to benefit from the joint participation of the ASTE committeemen.

Sanborn Describes, Shows Gear Making Equipment

Racine, Wis. — Approximately 100 members of Racine Chapter attended a dinner meeting November 4 when George H. Sanborn, Chief Field Engineer of The Fellows Gear Shaper Co., Springfield, Vt., spoke on Gear Cutting and Finishing Equipment.

G. H. Sanborn

A sound motion picture, "The Art of Generating and Gear Manufacturing Equipment," highlighted the speaker's talk. The film treated gear theory, design and action, and equipment for gear cutting, finishing, measuring and testing.

Lathe Turns Square

Toronto, Ont.—A film sequence showing a Monarch lathe turning a square captured the interest of the 175 Toronto Chapter members attending their November 11 meeting at Malloney's Art Gallery.

S. A. Brandenburg

The motion picture was exhibited by S. A. Brandenburg, Sales Manager, Monarch Machine Tool Co., Sidney, Ohio, to illustrate his address on machine tool design, with emphasis on the importance of automatic lathes in the production field.

With slides, he showed a variety of setups for fast, accurate and efficient turning operations. With the high speeds and feeds now available, he pointed out, loading time becomes a problem. A machine can lose much of its value as a production unit unless loading time is studied and methods devised to cut to a minimum "floor to floor" time, minus actual turning time.

Another point thoroughly discussed was fast chip removal necessitated by high speeds and feeds.

Machine tool manufacturers, he continued, expect to be busy for some time. Companies with modern machine tools buy late model machines, he added.

A sound film showed the Monarch Shapemaster turning mold cavities in a variety of intricate shapes. Many questions were asked during the ensuing discussion period.

First Vice-Chairman L. M. Jardine presided over the meeting for Chairman Walter Appleton, absent on an extended business trip to Vancouver.

Stainless Steel Program Presented by ASTE-ASM

Grand Rapids, Mich. — November meeting of Western Michigan Chapter was held jointly with ASM in the Rowe Hotel.

Speaker for the evening was R. H. Henke, Research Engineer of Allegheny-Ludlum Steel Corp., who discussed Stainless Steels.

Mr. Henke outlined the main types of stainless alloys, their analysis and properties. His talk was augmented with two films—one showing the welding of stainless steel, the other depicting machining to close tolerances with the Microtimer.

Approximately 125 members and guests of both Chapters were present.

"Budd Night" was observed by Philadelphia Chapter when their members met November 21 at the Engineers Club. J. C. Whitesell of the Edward G. Budd Co. gave principal address, "Tooling for Fabrication of Stainless Steel." Among those at the speakers' table are, left to right: F. M. Crayton, Past Chairman; William Fall, Assistant Chief Engineer, Rail Car Division and Lee M. Blugerman, Assistant Works Manager, Edward G. Budd Co.; A. R. Diamond, First Vice-Chairman; Dean H. W. Gross, Chairman; H. F. Holden, Treasurer; Joseph Danihel, Jr., Entertainment Chairman; and J. A. McManagle, Alternate

S.S. Machines Readily With Proper Equipment

Philadelphia, Pa.—Stainless steel is no harder to work than other metals, when proper equipment is available, according to John C. Whitesell, Superintendent of Plant Engineering, Edward G. Budd Mfg. Co., Philadelphia.

J. C. Whitesell

Mr. Whitesell stressed this point during an address on Tooling for Fabrication of Stainless Steel, before 250 members and guests of Philadelphia Chapter in a dinner meeting designated "Budd Night." The meeting took place November 21 at the Engineers Club.

The speaker related the many factors entering into the building of modern luxury railway cars, such as heating, lighting, plumbing, air conditioning and furnishing, for operation in temperatures ranging from 40° below zero to 125° above.

Tooling and Design Coordinated

Close cooperation is necessary between the design engineer and the tool engineer. The tool engineer should be ahead of design and bring out new methods that the design engineer can incorporate. He in turn must create a design that the tool engineer considers practical to build.

The six major sub-assemblies for strong, lightweight, stainless steel cars were described in detail.

Best results in machining are obtained by having the feed set when the cutter approaches the work, permitting the cut to start immediately. The cutter must advance steadily in a rigid machine until the cut is complete. Similar practice is employed in drilling, with a recommended cutting speed of 40 feet per minute.

Shearing is accomplished with high-carbon, high-chrome shear blades in a machine of twice the capacity of that ordinarily used for carbon steel. Three methods of sawing are used, according to the shape, size and thickness of the piece. The circular saw cuts in a straight line, whereas the metal bandsaw can cut to a pattern. The abrasive or metal friction saw is generally used for long pieces.

Shaping is done with a power brake, a Budd drawbench, or the power forming machine. Contours are formed in the three roll former, the power bender, or the stretcher press. Small quantity parts are spun, provided the spinning is not deep enough to require annealing.

The full text of Mr. Whitesell's lecture will be published in a forthcoming issue of *The Tool Engineer*.

After Mr. Whitesell's talk, the audience inspected samples of stainless steel corrugations and rail car beam sections. Drawings of power roll former, drawbench, three roll former, power bender and stretch press machines were also shown.

Edward G. Budd, President of the Budd company, who has since passed away, was prevented by illness from appearing on the program. Lee M. Blugerman, Assistant Works Manager, spoke briefly as his representative.

During the business meeting held earlier in the evening, Leonard Subber, Standards Chairman, outlined the work of his Committee, presenting a study of toggle clamps.

Straight Line Flow Facilitates Welding

Detroit, Mich. — Technical session at Detroit Chapter's meeting November 14 concerned "Welding Fixtures for Mass Production," presented by A. E. Rylander, Technical Editor of *The Tool Engineer*.

A. E. Rylander

Mr. Rylander's talk was based on straight line flow of a weldment from one fixture to another, the whole so timed and co-ordinated that, barring possible breakdown at any of the several stations, there are no bottlenecks impeding flow of work.

Crane lift, with its "leapfrogging" and consequent hazard to workers, is entirely eliminated as a result of the straight line flow.

In his talk, in which he was assisted by Fred W. Steiner, Editorial Associate, and Mrs. Sarah Gomes, Mr. Rylander's secretary, the speaker used working models and animated drawings to illustrate the fixtures.

The cutout cardboard illustrations enabled the audience to visualize the actual welding operations described. Mr. Rylander's paper, originally prepared for delivery at the Society's postponed Pittsburgh convention, was published in the December issue of *The Tool Engineer*.

Before the technical session, Robert Montgomery of the State Conservation Department presented hunting films and a travelogue.

Diamond Boring Tools Outlast Many Others

Grand Rapids, Mich.—October meeting of Western Michigan Chapter was held on the 14th at the Schuler Hotel in Grand Haven, approximately 60 members and guests attending.

Speaker for the evening was Donald A. Wallace, Vice-President of the Wheel Truing Tool Co., Detroit, who gave a demonstration and lecture on "Diamonds and Diamond Tools."

Mr. Wallace opened his address with a film, "Diamonds in the Rough," depicting operations in one of the largest African diamond mines. His talk included a brief history of the principal diamond fields, various types of diamonds found and their particular uses.

The speaker exhibited a number of industrial diamonds, as well as boring tools, showing the types of work produced. Because of their hardness, he pointed out, diamond boring tools outlast many times tools of other materials, but he cautioned that diamonds should be handled carefully, using only light cuts.

The latter part of the meeting was devoted to a question and answer period.

Hoener Joins Brighton

Brighton, Mich.—Edward L. Hoener, formerly connected with Hudson and Westinghouse Naval Ordnance, as Assistant Purchasing Agent for the U. S. Naval Arsenal at Center Line, is now associated with the Brighton Tool & Die Co., 735 N. Second St., Brighton, Mich., as Sales Engineer.

The Brighton company produces small jigs, fixtures, gages, metal stampings and eyelets.

Mr. Hoener is a member of Detroit Chapter, ASTE.

Rising, Chief Engineer

Holyoke, Mass. — Carl G. Rising, Superintendent, Metal Div., National Blank Book Co., has been advanced to Chief Engineer in charge of all engineering, new design, and methods.

C. G. Rising

Mr. Rising has been associated with National Blank Book since 1928. Previously he was employed by Dictaphone Corp., Bridgeport, and Yale & Towne Mfg. Co., Stamford, Conn.

He is a Past Chairman of Springfield Chapter, ASTE, and headed the Program Committee for the 1942 Semi-Annual Meeting in that city.

Rolled Thread Finish Comparable to .00001"

Erie, Pa. — With the aid of well-selected slide films, A. Bradford Reed, President of the Rolled Thread Die Co., Worcester, Mass., described the application of thread rolling to more than 50 members and guests of Erie Chapter at the group's dinner meeting November 5 in the General Electric Community Center.

A. B. Reed

Advantages of thread rolling, claimed by Mr. Reed, are: 1. Cold working of the metal increases strength; 2. Threads have increased shear strength; 3. Fatigue properties of the metal are increased; 4. Tolerances of .0005 to .002 can be maintained.

The speaker also pointed out that rolled threads have a surface finish comparable to 10 micro inches.

Among factors enumerated by Mr. Reed as retarding the more general use of rolled threads are: short die life makes thread rolling uneconomical on hard materials; and 20,000 piece lots are required to effect savings by this high production process.

During the business meeting which preceded the technical session, Chairman Harold Hagle reported on the activities of the local engineering societies in organizing an engineering council.

Guests from Atkinson Saw Co., American Meter Co., Inc., and Lord Mfg. Co. of Erie were introduced. New members, E. Norgren and T. B. Clan of General Electric Co., and E. Dundon of the Lord Mfg. Co., were also presented to the membership.

Jig and Fixture Talk

Atlanta, Ga.—"Practical Engineering of Jigs and Fixtures" was the subject presented by Clare Bryan, Consulting Tool Engineer of Link-Belt Co., Chicago, Ill., at the October 21 meeting of Atlanta Chapter, in the Georgia School of Technology.

Mr. Bryan, Chairman of Chicago Chapter, ASTE, illustrated his informative talk with slides.

Frank N. Shaw, Industrial Manager of Atlanta Chamber of Commerce, was a visitor and spoke briefly on the part that the local ASTE Chapter is playing in the industrialization program of Atlanta and Georgia.

Jet Planes Will Fly Faster Than Sound

Lynn, Mass.—Current airplane speeds of approximately 620 miles an hour may soon be exceeded by planes operating at or beyond the speed of sound, Reginald G. Standerwick, Engineer of the Aircraft Gas Turbine Div. of the General Electric River Works, predicted in an address, November 15, before 500 members and guests of Boston Chapter, ASTE, in the River Works Auditorium.

Mr. Standerwick, principal speaker at the dinner which concluded the program, revealed that planes are being constructed all over the world to surpass present speed records and set new marks exceeding anything ever believed possible in recent years.

He explained that any serious attempts to capture the world speed record for airplanes has been postponed by the United States until spring in order to achieve atmospheric conditions that will make the feat possible.

German Jet Secrets

Another highlight of the meeting was a detailed review of progress made by the Germans in the jet propulsion field prior to V-E Day, presented by E. E. Stoeckly, an engineer in the aircraft gas turbine department, sent to Germany at the close of the war to search out jet secrets.

Mr. Stoeckly showed pictures of German jet planes and crack fighter aircraft captured as American troops stormed across the Reich. Other views included Hitler's Bavarian hideout and the Dachau concentration camp.

Preceding the dinner, the engineers were guests at a demonstration of the G.E. River Works-built jet engines that powered Army planes in setting new speed records this year.

An added feature was the first Lynn showing of a new Walt Disney technicolor cartoon film portraying the story of G.E. jet propulsion.

A. W. Halvorson, Jr., Assistant to Works Manager George M. Stevens, welcomed the visitors to the River Works in a brief talk at the dinner and joined Mr. Standerwick in paying tribute to the contributions of tool engineers during the war years.

Send in Your Houston Hotel Reservation Form TODAY!

Plastics Utilized In Diemaking

New Haven, Conn. — Plastics can be advantageously applied to the making of low cost dies for forming soft metals such as aluminum and magnesium, according to W. O. Bracken, Assistant Products Supervisor, Cellulose Products Department, Hercules Powder Co., Inc., of Wilmington, Del.

Speaking before more than 100 engineers at a joint meeting of ASTE and ASM members, November 14, in the Dunham Electrical Laboratory of Yale University, Mr. Bracken described plastics from source to finished product, including raw materials used and adaptations of wartime plastics applications. Hot dipping of finished parts in a plastic protective coating continues popular, he said.

Some of the advantages of plastics in tooling are: light weight, low inventory, recast possibilities, flexibility and shock resistance.

A motion picture, "Careers of Cellulose," revealed the processes explained by Mr. Bracken. His comprehensive display of plastic products demonstrated the great possibilities of these materials.

MacCrehan, Professor At N. Y. University

New York City — William A. MacCrehan, Jr., has been appointed Assistant Professor of Administrative Engineering and Director of The Gage Laboratory at New York University.

W. A. MacCrehan, Jr.

Prof. MacCrehan is a well-known New England Consulting Engineer in Quality Control. For the past two years, he has been Supervisor of Quality Control in the Motor Div. of the Lynn River Works, General Electric Co.

Instructor for the State University Extension Courses in Quality Control at Harvard University, for three years, he also taught this subject at Boston University Evening College of Commerce during the 1945-46 term.

Prof. MacCrehan is a member of AIEE, ASTE, ASA, BSQC and NSQC. He has written and delivered many lectures on the subject of Statistical Quality Control.

Ladies Night Features "Prof." Oakes, "Wizard of Waukesha"

Fond du Lac members and their feminine guests enjoy Ladies Night dinner function at the Beaumont Hotel in Green Bay, Wis., November 8. At speakers' table, from left to right, are: William Felten, Past Chm.; N. R. Boynton, Treas.; Mrs. W. E. Rutz, Mrs. D. G. Storms, W. E. Rutz, Toastmaster; Mrs. Russell Oakes, L. J. Kaufman, Chm.; Russell Oakes, speaker of the evening; Mrs. L. J. Kaufman, Mrs. Jule Schommer, D. G. Storms, Secy.; Mrs. Gideon Kane, Jule Schommer 1st V.-Chm.; Gideon Kane (standing) Past Chm.; and Mrs. William Felten. "Professor" Russell Oakes, the "Wizard of Waukesha," demonstrated amusing gadgets. Dinner music was furnished by some of the members, and vocal selections were rendered by a local baritone

South Bend Chapter Sees Axle Making at Clark Equipment

South Bend members arrive at Clark Equipment Co., Buchanan, Mich., for a tour of the plant. The party was provided with safety glasses and escorted through the factory in small groups. After watching the production of automobile rear axle forgings, the visitors were shown the company's new development laboratory. Approximately 100 engineers made the November 12 trip to the Michigan plant, scheduled in place of the usual monthly meeting

Tin Can Production Fully Mechanized

Los Angeles, Calif—How tin cans are manufactured on completely automatic production lines was demonstrated to 131 Los Angeles Chapter members who visited American Can Company's Vernon plant, in lieu of their November meeting.

After dinner at the plant cafeteria, engineers of the host company guided small groups of visitors through the sprawling factory. Although the equipment is not the most modern, cans are produced here at the rate of 375 per minute.

Printed in Sheets

Stacks of tin plate are placed in hoppers of machines, to be automatically lacquered or printed. Conveyors carry these sheets through drying ovens and groups of slitting machines. There stacks of blanks are gathered and transferred to can making machines.

Along a mandrel, approximately 20 feet long, are positioned all the tools that transform the rectangular blank into cans with airtight seams. First, the blanks are wrapped around the mandrel in a number of steps, then spotwelding electrodes tack the ends of the overlapping seam.

The can now advances through the operations of fluxing, drying, soldering, and finally drops off the mandrel onto a conveyor that carries it overhead to the testing machine, which automatically eliminates leaky cans.

Spinning Heads Attach Bottom

Again the cans pass over conveyors to spinning heads which turn a flange on both ends of the cylinders and assemble a prepared bottom, fed to this point from another line. The now finished product is dropped onto still another conveyor that carries the cans to a second testing machine. From here the unrejected cans are distributed via an elaborate system of conveyors to a number of packing stations to be prepared for shipment.

Not only does this company build its own machines and make its own tools, but it also manufactures the bags, cartons and glue used in shipping its product to consumers.

Just as mechanized as the making of the cans is the production of tops and bottoms. From stacks, sheets of metal are fed into so-called scroll shears which cut them into strips with a racktoothlike contour.

Stacks of these strips are transferred to punch presses. Here, like magic, steel fingers lift one strip, other fingers shove it in front of a roll feed, while a third one starts it into the rolls.

When the strip leaves the punch press on the other side, nothing but a thin fuzz of metal remains. This is baled and remelted to be made into more cans. The blanks are conveyed to presses which crimp the edge in preparation for assembly. From here they go through a machine which deposits and bakes a rubber-like material into a groove, to later form an airtight seal with the can body.

There is at least one line running for each size can used, and although the smaller ones run at speeds where observation of the individual can is not possible, jams are said to be rare.

Lovejoy Promotes Proctor To Chief Sales Engineer

Springfield, Vt.—The appointment of Don H. Proctor as Chief Sales Engineer has been announced by Lovejoy Tool Co.

D. H. Proctor

Mr. Proctor has been with the company 28 years in a manufacturing and sales capacity. For the past six years, he has sold exclusively in the New England area.

A. M. David, formerly Sales Engineer for Firth-Sterling Steel Co., McKeesport, Pa., is taking Mr. Proctor's place as New England District Representative.

Mr. Proctor is a member of Twin States Chapter, ASTE, while Mr. David is affiliated with Hartford Chapter.

Alexandria, Pacific Vet Now With Metalcraft

Evansville, Ind.—Kenneth Alexandria has joined the staff of Metalcraft, Inc., as tool designer, following his return from army service at Manila, P. I.

Before entering the armed forces in July of 1942, Mr. Alexandria was a plant layout man at Hoosier Cardinal Corp. Earlier he was employed as draftsman by George Koch & Sons.

A member of Evansville Chapter, ASTE, the former corporal is taking advantage of the G. I. educational program to further his technical training with engineering studies at Evansville College.

Predicts New Uses For Crush Dressing

St. Catharines, Ont. — J. T. Welch, Sales Engineer for The Sheffield Corp., Dayton, Ohio, addressed over 120 dinner guests at the November meeting of Niagara District Chapter.

J. T. Welch

In his talk, "Crush Form Dressing of Grinding Wheels," the speaker named as advantages of this method over diamond dressing: 1. More economical for mass production grinding and tool grinding in lots over six; 2. Grinding wheel lasts longer, holds form longer and gives superior finish; 3. Tendency of wheel to load up and glaze is reduced; and 4. Allows grinding of intricate forms impractical to dress with a diamond.

Mr. Welch claimed that the limited use of this method today is due to lack of technical knowledge — a situation which ASTE and equipment manufacturers are attempting to remedy. He gave credit to the British for originating and pioneering crushed form dressing and predicted wide industrial applications in the near future.

During the evening, C. D. Wright was presented with a Past Chairman pin. The attendance was swelled by members from such distant points as Ingersoll, Woodstock, Toronto and Hamilton.

Hydraulic Press Permits Varied Stroke Sequence

Toledo, Ohio—"Silent Power Speaks Productivity," 96 Toledo Chapter members learned during an address on this subject by Howard F. Levenhagen, District Sales Manager, Denison Engineering Co., Columbus.

Mr. Levenhagen was the technical speaker November 13 at a meeting in the Toledo Yacht Club.

The speaker discussed recent developments in small hydraulic presses and showed slides of tooling applications, such as sheet metal stamping and injection molding.

Due to very accurate control, it is possible to obtain a sequence of different strokes, such as a dwell, followed by three short strokes. This application is used in torque testing of axle shafts. Many other uses of equal importance were also shown. Included in the program were two small machines, operated on typical applications.

A·S·T·E· Productioneers

YOUR CENTRAL OFFICE STAFF

SEMI-INDEPENDENT of other Central Office operations is the preparation of the "Tool Engineers' Handbook," which is set up on a project basis. The work of the Handbook staff is based on long-range planning, looking toward the output of a single definite product, on as precise a publishing schedule as the many intangibles of a first edition will permit.

While heading up all Handbook work, Frank W. Wilson, the editor, is largely concerned with the establishing and maintaining of policy and of contacts with several hundred authors and reviewing editors; determining the kind and scope of data for each Handbook section; personally reviewing every manuscript for the approximately 125 separate sections or writing assignments; all dealings with the publisher, and "a few other things."

Involves 26 Operations

"We're a manufacturing operation here," explains Editor Wilson, "as that schedule board on the wall shows. For every manuscript there are 26 basic steps to be taken. Each member of the staff is responsible for some of these operations and must do his or her own posting on the board. So, our sins are ever before us.

"'Hobby'? I looked that up once, and it derives from 'a small ambling horse.' Nope, no horses, but interests . . . in people . . . in books—generally on off-the-beaten-track subjects—most of all, in the job in hand," he acknowledges.

Mr. Wilson plunged into his assignment January 2, 1945, coming to the Society from McGraw-Hill Publishing Co. in New York, where he was Copy Chief of the Catalog and Directory Div., concerned with publications in the electrical, mechanical, textile, food processing and mining industries.

His varied experience, after graduating in Industrial Engineering from New York University, also includes industrial free-lance copywriting and sales promotion planning.

* * *

In very capable fashion, Carleton F. Worfolk holds down the assistant editor's post. Most of his energy is channelled into the editing of manuscripts, both before and after reviewing committees have made their recommendations. It is largely his responsibility to revise copy to conform to Handbook policies and objectives. If promotional or controversial claims have crept into the manuscript, if there are obvious "holes" in the copy, or if rewriting is needed for better sequence or clarity—it's up to him.

A recent addition to the staff, Mr. Worfolk has quickly proved his ability to meet and overcome the myriad details with painstaking care. He has brought to the job a sunny disposition and infectious enthusiasm. Out of his broad experience, happily combining engineering training and actual shop work, he works with a solid background of theory, yet can talk the "grease-monkey" jargon.

Among his earlier associations, he was Engineering Assistant in the renowned old Detroit Engine Works. He was first to utilize cast steel for crankshaft material in combustion engines, designing and tooling up these engines as well as the prototype of the now famous miniature, side-crank washing machine engine.

Assigned to Ordnance

Later he was connected with Dodge Bros., General Motors and Hudson Motor Car Co. During the war years, he was Senior Mechanical Engineer on the staff of Smith-Hinchman & Grylls, Inc., detailed for official duty with the Commanding Officer, Office, Chief of Ordnance, Detroit.

At his home in Algonac, within sight of the St. Clair River, Mr. Worfolk has the "most untidy basement workshop in Michigan"; exercises his culinary skill; studies Greek, Russian and English. He has two sons, a daughter and an assortment of grandchildren; gardens, cleans two blocks of sidewalk after snowstorms; drives a hundred miles daily to and from the office; and is a vestryman at St. Andrew's Episcopal Church in his home community.

* * *

Veteran of the Handbook staff is Frances Watson who was transferred from other Central Office duties with the initiation of this project.

Besides handling voluminous correspondence with manufacturers, associations, authors and others, she has charge of the numerous reports and follow-up letters required to keep committees informed and to coax authors to meet their deadlines. She reviews and classifies by subject, articles in the leading industrial periodicals. As corresponding librarian, Frances procures needed research material from local libraries; arranges travel itineraries for Mr. Wilson; and works her way through what the editor facetiously terms "leisure projects."

Employed at Tank Automotive

Her varied secretarial career includes service in the Governor's office, with Dodge Bros., Truck Engineering Div., the Michigan Public Utilities Commission and the Medical Service Department at Parke, Davis & Co. During the war she worked in the Development Branch of the Tank Automotive Center, Synthetic Rubber Div., leaving this agency in September of 1943 to become affiliated with the Society's staff.

A native of Michigan, she graduated from Detroit Central High School, Detroit Business Institute, and has taken courses at Wayne University.

By way of hobbies, Frances once had the popular urge to write the "Great American Novel," but abandoned that ambition in favor of dashing off an occasional article delineating the heterogeneous existence of Herman Gardens Housing Project residents, for their local paper. Her chief interest centers around her 17-year-old daughter.

While one doesn't ordinarily think of one's job as a hobby, Mrs. Watson really enjoys her part in the work of getting out the Handbook.

* * *

Wanda Sumner joined the Handbook personnel in June when manuscripts began to arrive. On her falls the task of typing the revised papers from the editors' scribblings, from marked typewritten pages and tear sheets, by dictaphone and word of mouth. She wouldn't be surprised if they gave it to her by television next.

She processes all the art material,

Carleton Worfolk's broad engineering background gives him a practical perspective in editing Handbook manuscripts. Right: Madison L. Crawford, of the Clark Tructractor Div. of Clark Equipment Co., visits the Central Office to discuss his manuscript with Handbook Editor Frank W. Wilson (right)

identifying and recording each drawing, chart or other illustration; orders photostats and blueprints. Another of Wanda's critically important duties is to secure publishing permissions and releases from authors, societies, publications, companies and others, whose material is desired for inclusion in the Handbook. In addition, she lists contents, tables and illustrations for every Handbook section, and cuts mimeograph stencils of communications to authors and committees.

Born in West Frankfort, Ill., Wanda graduated from the Frankfort Community High School in 1941. For three years she was employed by the War Department, assigned to the Intelligence Branch in Boca Raton, Fla., and later at San Antonio, Texas.

Deftly combining business and homemaking, she is as efficient at whipping up delectable meals for her husband as in executing her share of the Handbook detail.

Frances Watson checks a Handbook contributor who assures her that his manuscript is on its way to the Handbook Editor at the Central Office

Wanda Sumner cuts a mimeograph stencil of one of the innumerable reports issued to the Handbook Committee and its various sub-committees

Many Tools Gain Carbon With Proper Heat Treat

Rochester, N. Y.—The joint annual meeting of Rochester Chapters, ASM and ASTE, occurred November 11 at the Powers Hotel, with the former organization as hosts.

Technical speaker of the evening was W. A. Schlegel, Metallurgical Dept., Carpenter Steel Co., Reading, Pa. The subject of his talk was "High Speed Steel and Its Heat Treatment."

Edward Spanagel (left), Rochester ASM Chapter Chairman, presents Vernon Patterson (right) with his Past Chairman certificate, framed in stainless steel, as Charles Seely, Chairman of the ASTE Rochester Chapter looks on. Presentation occurred during joint meeting of the two organizations, held November 11 in the Powers Hotel

With the aid of charts and illustrated slides, Mr. Schlegel related actual cases of heat treating high speed steels, 18-4-1 tungsten steels, and M2 molybdenum steels at various manufacturing plants in the United States and Canada.

He pointed out that tools are much more likely to pick up carbon than to lose it when heat treated under correct, controlled atmospheres. None of this pickup could be ascribed to the tempering process, he maintains.

The speaker also showed with slides that microscopic examination of etched samples will enable a metallurgist to tell from the grain structure whether the specimen has been properly treated or correctly heated.

The after-dinner speaker, Col. John H. Belknap, head of the Division of Engineering, University of Rochester, gave a color-slide illustrated talk on his experiences as Deputy Chief of the Machinery and Optics Section of the U. S. Office of Military Government for Germany. The pictures depicted the terrible destruction inflicted upon Berlin, Frankfort, Cologne and other German cities and towns, by the Allied Military forces.

Edward Spanagel, ASM Chapter Chairman, who presided at the meeting, presented a stainless-steel-framed Past Chairman certificate to Vernon Patterson, former head of the local ASM group.

Mr. Spanagel also paid tribute to ASM member Frank MacDonald, a veteran heat treater who recently retired from his long service with the Ritter Co.

The technical speaker was introduced by William Conley of the host organization.

Approximately 230 members and guests of both societies were present.

Russia Wants Peace Says World Traveler

Elmira, N. Y.—Guest speaker at the Annual Ladies Night held by Elmira Chapter, November 12, in the Mark Twain Hotel, was Gordon Rydenhower of Program Associates, Utica.

His subject, "Around the World in Fifty Minutes," was based on observations made during his three years of war service.

The Fiji Islands he considers the best of the many islands dotting the South Pacific. Briefly he touched on Australia and its problems.

Filipinos, he believes, are not yet ready for independence. The influence of China and Russia may cause trouble in the archipelago in three years, he anticipates.

At Tokyo he found the prevailing sentiment friendly. The people realize their mistake in going to war, fear Russia and respect MacArthur.

Mr. Rydenhower scored the Nationalist government in China for corruption; feels that in 50-70 years China can dominate Asia and parts of Europe.

His resume of Russian communism was concluded with the expressed conviction that the Soviet union desires peace with the U. S., knowing that a future war is out of the question.

The English, he thinks, have lost some of their prestige and traditions. Internationalism, he summarized, is the order of the day and necessary for world peace—a must for the continuance of civilization.

Dancing followed Mr. Rydenhower's talk. Approximately 150 members and their guests attended the annual dinner function.

Good Tool Design Reduces Spoilage

Milwaukee, Wis.—William K. Andrew, Engineering Sales Manager of Kearney & Trecker Corp., was the speaker of the evening at a meeting of Milwaukee Chapter in the Elks Club, November 14. Mr. Andrew's subject was "Fixture Design."

Sound tool design, he explained, incorporated with good machine tool design in operation, cuts manufacturing costs to a minimum. Part scrap or failure due to the human element is eliminated, while production output is maintained, since the fixtures and machine do most of the "brainwork."

As an example, Mr. Andrew cited the results of good fixture and tool design in the automotive industry which had reduced prewar production costs in the United States so that the average worker could buy a new car every year, compared with a two and five year automobile turnover for British and Russian workers, respectively.

The speaker showed a number of slides illustrating good fixture design and application.

At the conclusion of his technical lecture, Mr. Andrews, who is President of the Wisconsin Geological Society, showed films of a Western trip, depicting geological points of interest.

Winter Looks at Future Of Tool Engineering

Peoria, Ill.—Otto W. Winter, National Education Chairman of ASTE, presented "Future Aspects of Tool Engineering" to Peoria Chapter members at their November meeting in the Jefferson Hotel.

Tracing the history, aims and growth of tool engineering, he explained the difficulties to be overcome in attaining professional equality with other branches of engineering. Problems concerning registration of engineers were pointed out by the speaker.

Mr. Winter also outlined the professional program of the Society and its public and industrial relations policies.

The speaker was introduced by W. H. Neptun, Education Chairman of the Chapter.

Morgan Baldridge of Hobbymodels in an earlier talk described one, two and five cylinder motors, jet motors, racing cars and airplanes, displaying several models.

James Y. Scott, President of the Van Norman Machine Tool Co. (left), is introduced at the Executives' Night meeting of Greater New York Chapter, November 4, by T. P. Orchard, Toastmaster

Stresses Tooling to Cut High Production Costs

Chicago, Ill.—"Tooling Up to Keep Costs Down—and How," was the theme of an address by R. R. Rhodehamel, General Sales Manager of National Acme Co., Cleveland, Ohio, before more than 200 members and guests of Chicago Chapter.

R. R. Rhodehamel

Mr. Rhodehamel was the principal speaker at a dinner meeting November 4 in the Furniture Club of America.

His presentation on automatics included basic principles of modern tooling, comparison of production gains by six-spindle setups over four-spindle, and the use of attachments to perform additional operations and eliminate extra machines. He emphasized tooling to offset the increased cost of labor.

Mr. Rhodehamel also discussed self-opening die heads with circular chasers, and their adaptability other than threading, such as end forming, end turning, knurling and burnishing.

Director C. B. Cole reported on the Society's recent Semi-Annual Meeting.

Sargent Discusses Automotive Tooling

Houston, Texas — A. M. Sargent, ASTE President, was a recent guest speaker at Houston Chapter.

Mr. Sargent discussed tooling methods in the automotive industry and cited numerous instances where the tool engineer implemented the war effort.

Frank Adams, of Westinghouse Electric Corp., gave the technical address of the evening, "Electrical Maintenance." His remarks concerning care and operation of electrical equipment were especially timely in a period of extreme shortages in this field.

Mr. Adams stressed some of the principal causes of motor failures, telling how to locate and eliminate these causes. Two films, "What Is Electricity," and "Electronics at Work," illustrated the talk.

Mr. Adams was presented to the Chapter by H. L. Friedrich, head of the Industrial Div., Houston Office of Westinghouse.

The coffee speaker, G. W. (Scotty) Scott, related Optomist Club activities in Houston, outlining their program for the welfare of young boys, and their efforts in bettering living conditions for the underprivileged.

The meeting in the Houston Country Club was attended by approximately 100 members.

U. S. Future Depends on Production, Scott Says

New York City — "Production was largely responsible for the present American standard of living, and only a return to efficient volume production can insure a continued upward trend," James Y. Scott, President of the Van Norman Machine Tool Co., Springfield, Mass., recently told members of Greater New York Chapter and their executive guests.

Speaking to 30 executives in key industries in the metropolitan area and over 170 Chapter members who were assembled for a dinner meeting in Hotel New Yorker, November 4, Mr. Scott declared, "We will never have world peace until we first learn how to handle our domestic problems with a minimum of strife. Now, more than ever before, we need real understanding between labor and management. Both parties must learn that the welfare of one affects the welfare of the other, and must be educated to the fact that the value of the dollar is based on the value of the goods produced."

U. S. Only Major Producer

"Before the war," Mr. Scott said, "four countries—the U. S., Germany, England and Japan—had a production capacity that supplied 88 per cent of the world's manufactured goods. Today, two of these countries have been dismantled; England is struggling to overcome the effects of the terrific pounding given her by enemy air forces and buzz-bombs. Only the U. S. is capable of supplying the goods for rehabilitation of war-torn countries. We owe it to the rest of the world as well as to ourselves to produce as much as we can, as fast as we can."

Mr. Scott emphasized that the challenge of America is how well the people handle her factories. For that job, America needs men of great vision.

Scientific Tooling Aids Economy

Also a featured speaker at the dinner was H. E. Conrad, ASTE Executive Secretary. Stating that one of the key objectives of the Society is to make a more exact science of tool engineering so that industry can make goods at lower prices while paying higher wages, Mr. Conrad discussed some of the ways in which the organization is approaching that goal, laying particular emphasis on its educational program.

Mr. Scott and Mr. Conrad were introduced by Thomas P. Orchard, retired Second Vice-President, who acted as toastmaster. Others at the speakers' table were Holbrook L. Horton, Chairman; Harmon S. Hunt, First Vice-Chairman; and Edward Novack, Second Vice-Chairman of Greater New York Chapter, and other members of the executive committee.

Many Executives Present

Guest executives included Rear Admiral F. E. Haeberle, Commander of the Brooklyn Navy Yard, and Lt. H. W. Holschuh, Aide to Admiral Haeberle; O. Brullhard, Vice-Pres., and A. Steinhart, Tool Engineer, of the Bulova Watch Co.; J. D. Spaulding, Works Mgr., M. M. Munson, Supt., E. Burridge, Plant Supt., and Dave Cohen, Tool Supt., of the Nathan Mfg. Co.; J. A. Auer, Pres., and H. Protze, Plant Mgr., of R. H. Hoe & Co.

G. W. Gross, Plant Supt., A. Schrader's Sons; Frank Koebel, Pres., J. K. Smit Sons; George Allison, Works Mgr., and Carl Burgwald, Plant Supt., of the Mergenthaler Linotype Corp.; A. E. Edwards, Vice-Pres. and Works Mgr., and F. Zwetch, Plant Supt., Ford Instrument Co.; Carl Holschuh, Works Mgr., E. E. DaParma, Personnel Mgr., E. U. DaParma, Asst. Works Mgr., and G. A. Richroath, Mfg. Mgr., Sperry Gyroscope Co., Inc.; W. H. Lentz, Works Mgr., and Vernon Johnson, Industrial Engineer, of the American Machine and Foundry Co.

J. M. Talbot, Vice-Pres. and Gen. Mgr., W. Uhler, Chief Engineer, and A. J. Cawse, Gen. Supt., of S. S. White Dental Mfg. Co.; John Kenny, Tool Engineer, Brooklyn Navy Yard; John Hornung, Supervisor and Plant Mgr., John Saukup, Supt., and Max Hartwig, Gen. Tool Supervisor, Otis Elevator Co.; A. Marchev, Pres., J. P. Bauer, Mfg. Mgr., and H. Lasker, Mgr., of the Seabee Div., Republic Aviation Corp.

F. W. Weigold, Vice-Pres., and J. Marksteiner, Supt., Arma Corp., and D. Rittenhause, Factory Mgr., and William Hoffman, Asst. Factory Mgr., Grumman Aircraft Engineering Corp.

Houston members turned out in force when President A. M. Sargent was a guest speaker at a recent Chapter meeting. In the lower view, Chapter officers are shown at the speakers' table (right) with Mr. Sargent

Butler Analyzes Tool Steels, Recommends Uses

Muncie, Ind.—In a concise, informative lecture, packed with vital technical data, Dr. G. M. Butler, Jr., Associate Director of Research, Allegheny Ludlum Steel Corp., Dunkirk, N. Y., told Muncie members about "Steels for the Tool Engineer."

Speaking before a recent dinner meeting of the Chapter, Dr. Butler explained that tool steels must be custom made in relatively small lots, in a vast number of sizes, shapes and grades.

These steels, therefore, are the products of small, flexible mills which can keep thousands of individual orders flowing through quickly. Such mills are quality conscious throughout, and all their operations are designed to give the reliability synomynous with the phrase "tool steel."

Custom Steels Justify Cost

While the individual attention to many small orders, as well as the large stocks and staffs required to render prompt service, all contribute to the high cost of tool steels, the resulting uniformity of quality, dependability and availability make the best steel for the job a good investment.

Dr. Butler classified tool steels into five groups: straight carbon and low-alloy, cold work, shock-resisting, hot work and high speed types.

In describing the composition, characteristics, advantages, drawbacks and uses of each group, he presented exact technical data pertinent to the various classifications.

When the carbon and low-alloy tool steels fail to give good results, the job is analyzed and a better steel sought from one of the other groups. For blanking, coining, forming, drawing, stamping or otherwise shaping at room temperatures, a cold work die steel should be selected.

If extreme shock and repeated battering is to be resisted, as in chiseling or punching, a shock resisting steel is selected from two types, depending on the severity of the work.

To forge, press, trim, extrude or otherwise hot form metal, a hot work steel is chosen from the chromium group, if for moderate temperatures or severe shock, and from the tungsten steels if temperatures are high and pressure rather than shock to be resisted.

Rapid cutting of metal requires a high speed steel—a tungsten-molybdenum or molybdenum type if toughness and saving in steel cost are more desirable than greatest latitude in heat treatment. If these steels are inadequate, recourse will be had to steels with higher vanadium content to resist abrasion or with cobalt to withstand greater heat, Dr. Butler pointed out.

Following his talk, the speaker showed colored films on the manufacture of tool steel and stainless steels.

Frazure Promoted

Chicago, Ill.—R. F. Frazure, formerly Toledo District Manager of Latrobe Electric Steel Co., has been promoted to the managership of the Chicago area, with offices at 2039 W. Jackson Blvd., Chicago.

R. F. Frazure

An active member of Toledo Chapter, ASTE, for several years, Mr. Frazure is now affiliated with the Society's Chapter at Chicago.

Kane Heads Packer

Green Bay, Wis.—Gideon Kane, for the past 21 years with Northwest Engineering Co., as Production Engineer and Chief Tool Designer, has resigned to head his own company, Packer Manufacturing Co., also located at Green Bay. The Packer concern manufactures printing presses and food processing equipment.

Mr. Kane is immediate Past Chairman of Fond du Lac Chapter, ASTE.

Sanborn Illustrates Lecture with Gear Models

George H. Sanborn, Chief Field Engineer of The Fellows Gear Shaper Co., Springfield, Vt., explains model of involute gear tooth, following his address, "The Art of Generating and Gear Manufacturing Equipment," given before 76 members and guests of Syracuse Chapter, at meeting November 12 in the Onondaga Hotel. After dinner speaker was Terence Dundon who described conditions noted during his recent trip to England

Hamilton members hear L. M. Krull of the Bay State Co. relate new developments in grinding at recent meeting in the Walper House at Kitchener. Above at the speakers' table are, left to right: H. J. Sehl, A. H. Welker, R. G. Fechnay, T. G. Fechnay, W. A. Alexander, 1st V.-Chm.; J. N. Walton, Chm.; Mr. Krull, W. A. Dawson, Natl. Asst. Secy-Treas.; A. S. Capwell and W. Orlick

Mysteries of Television Unfolded in Open Forum

Hamilton, Ont.—"Electronics—Castles in the Air" was the subject presented by Eric Palin, Chief Instructor in Electronics at the Rehabilitation School, Toronto, before a meeting of Hamilton Chapter members, November 8, in Fischer's Hotel.

Mr. Palin's discussion was in the form of a question and answer forum, a method which he has found successful in explaining television.

Approximately 60 members and guests attended the dinner meeting.

* * *

At an earlier meeting, L. M. Krull, Treasurer, Bay State Co., Westboro, Mass., spoke on "New Developments in the Field of Grinding." Popular interest in the subject was evident from the many questions, capably answered by Mr. Krull at the conclusion of his talk.

Prior to his address, a film, "Production of Grinding Wheels," was shown.

An attendance of more than 140 was present for the dinner and technical session at the Walper House in Kitchener.

Gives Safety Suggestions For Press Operation

Baltimore, Md.—Principal speaker at Baltimore Chapter's November 6 meeting in the Engineers Club was Joseph I. Karash, Plant and Process Engineer of The Reliance Electric & Engineering Co., Cleveland, Ohio, whose subject was "Design of Dies for Inclinable Punch Presses."

Mr. Karash emphasized the safety angle of using inclinable presses, giving many practical suggestions. The talk was illustrated with a series of slides.

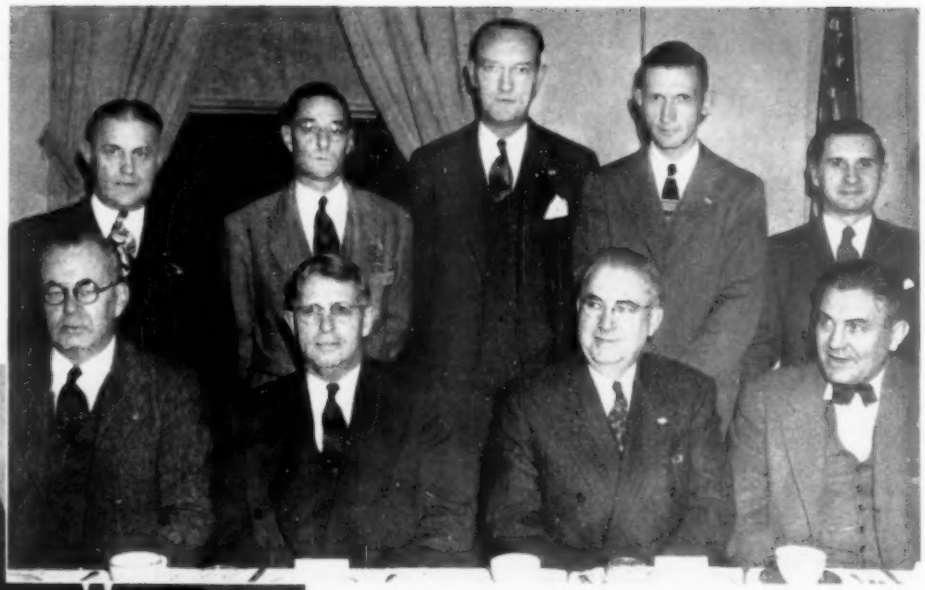
Firm Incorporates

Philadelphia, Pa.—Arthur C. Jackson, President, has announced the incorporation of Jackson-Walter Co., as successor to Jackson Associates.

Joseph H. Walter is Vice-President of the new company which has been organized to extend the firm's activities and service.

Both Mr. Jackson and Mr. Walter are members of Philadelphia Chapter, ASTE.

Hartford Chapter observed its Tenth Anniversary with a dinner at the City Club, November 7. Among those at the speakers' table were (below, seated left to right): Victor H. Ericson, National Treasurer; Richard A. Smith, First Vice-Chairman; and Harry W. Conrad, the Society's Executive Secretary. Standing: Andrew E. Rylander, Technical Editor of *The Tool Engineer*; and William F. Jarvis, Second Vice-Chairman



All former Chapter Chairmen attended Hartford's anniversary night. Seated, left to right, are: A. H. d'Arcambal, H. I. Moore, I. F. Holland and Ray H. Morris. Standing: H. J. Hauck, C. W. Moeller, George A. Highberg, Henry Rockwell and Edmond Morancey (incumbent)

Tenth Anniversary Night Features Tool Steel Talk

Hartford, Conn. — Hartford Chapter celebrated its Tenth Anniversary with a dinner meeting, November 7, attended by approximately 200 members and guests, including visiting Chapter and National officials.

Dinner was served at the City Club where head table guests and charter members were introduced. A. E. Rylander, Technical Editor of *The Tool Engineer*, was the after-dinner speaker. Only through high production, he said, can we acquire the comforts and luxuries to maintain a high standard of living. He also emphasized the importance of developing Chapter executives from among the younger members, to continue the work of the "old timers."

The group adjourned to the Hartford Gas Co. Auditorium for the meeting, with Past President Ray H. Morris acting as master of ceremonies. Before presenting the guest speakers, he reviewed the highlights of the Chapter's progress during its ten years of existence.

1st Chairman, Technical Speaker

Technical speaker was A. H. d'Arcambal, Vice-President — Consulting Metallurgist, Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford. His lecture, "Materials for Precision Cutting Tools and Gages," was augmented with slides and samples.

In his talk, Mr. d'Arcambal traced the development of heat treating as applied to tools, indicated a preference for 18-4-1 steel, and outlined future uses of nitrided tools. A Past President of the Society, he was the first Chairman of Hartford Chapter.

Others who spoke included James R. Weaver, Past President; I. F. Holland, Second Vice-President; V. H. Ericson, National Treasurer; Harry E. Conrad, Executive Secretary; and the Past Chairmen of the Chapter.

Among out-of-town guests were Frank W. Curtis, Past President; John Lindegren, National Membership Committeeman; and chairmen of other New England Chapters.

New Balancing Machine Has Automatic Corrective

Moline, Ill.—October 21 meeting of Tri-Cities Chapter featured Werner I. Senger, Manager of the Balancing Machine Div., Gisholt Machine Co., Madison, Wis.

W. I. Senger

Mr. Senger ably enumerated steps in the development of static and dynamic balancing. The accompanying film revealed the detailed operations of the latest type of dynamic balancing machine with automatic corrective means, which assures industry of higher speeds and less vibration in rotating bodies.

Coffee speaker was Herbert E. Wilson, Editor of the *Rock Island Argus*, who discussed "Today's Scene." Mr. Wilson made some enlightening observations on business, labor and politics, dominant in the headlines of the day.

Van Dusen with Schnacke

Evansville, Ind. — Walter Van Dusen is now Production Engineer for Schnacke Mfg. Corp., producers of modern 5 to 50 ton refrigerating compressors.

He was formerly Planning Engineer for Chrysler Corp. and Tool Engineer for Love Machine and Tool Co., Indianapolis.

Mr. Van Dusen is a charter member of Evansville Chapter, ASTE.

Promoted by Hoosier

Evansville, Ind. — Richard Parmalee, formerly Staff Assistant to the Vice-President in Charge of Production at Hoosier-Cardinal Corp., has been promoted to Assistant Superintendent of the Plastics Div.

Mr. Parmalee's service with the Hoosier organization, begun in 1938, was interrupted when he enlisted in the U. S. Naval Reserve. For 22 months he was stationed at Hawaii as an officer with the Ground Forces of the Naval Air Patrol, returning to the mainland late in 1945 to act as personnel officer at the Navy Air Station, Glenview, Ill.

Upon his discharge as Lt. J.G. in January of 1946, he accepted the position he held at Hoosier-Cardinal before his recent advancement.

Mr. Parmalee has been a member of Evansville Chapter since its chartering last May.

Represents Kelly Reamer

Chicago, Ill. — Thomas C. Barber, owner of Tool Service for Industry, has been appointed Engineering and Sales Representative in Wisconsin, by The Kelly Reamer Co. of Cleveland, according to a recent announcement. His appointment enlarges the territory previously serviced.

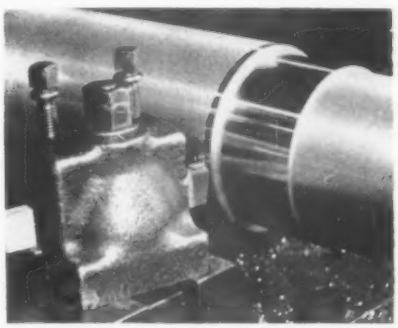
T. C. Barber

Mr. Barber is Chairman of the Membership Committee, Chicago Chapter, ASTE.

FILM · FLASHES

Everyday Miracles dramatizes recent contributions to industrial progress by cemented carbide, claimed to be the world's hardest metal.

The film is designed to familiarize users of hard metal carbides with recent accomplishments resulting from the use of these metals, as well as to stimulate suggestions for new applications. A general interest plot, combined with various specialized motion picture techniques, is employed to tell the story of past, present and possible future of carbides.



Fine finishes like this are shown in the Carboloy sound motion picture, "Everyday Miracles"

The picturization of the making of carbides is valuable to industrial groups in view of the relation of this subject to utilization of hard metals.

The production, filmed in the main plant of Carboloy Co., Inc., at Detroit and in the studios of Wilding Pictures, describes some of the industrial methods developed through the adoption of carbide tools, dies, wear resistant inserts, and other Carboloy parts.

Ending on a prophetic note, the motion picture points out that carbides are not restricted to tool-tipping, but are actually becoming a new series of "use" metals whose practical applications seem limited only by the imagination of development engineers and designers.

Prints of the 16 mm., 25-minute sound film may be borrowed by technical societies and industrial plants, from Modern Talking Picture Service, 9 Rockefeller Plaza, New York 20, N. Y.

d'Arcambal Gives Woodside Lecture

Detroit, Mich. — A. H. d'Arcambal, Vice-President—Consulting Metallurgist of Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn., delivered the annual Woodside Lecture, October 14, before the regional conference of Detroit Chapter, ASM.

A. H. d'Arcambal

Mr. d'Arcambal chose "Tool Steels" as the subject of the yearly lecture honoring William Park Woodside, only living founder of ASM.

A former President of ASTE, Mr. d'Arcambal is a member of the Society's Judicial Committee.

Talks on Reaming

Pontiac, Mich. — Approximately 100 members and guests attended a dinner meeting of Pontiac Chapter, October 17, in Pontiac Motor dining hall.

Principal speaker of the evening was Carl Asthrope of The Cleveland Twist Drill Co. He lectured on reaming and showed pictures, later conducting a discussion period.

Charles Staples, Past Chairman of the Chapter, addressed the group, outlining reasons for affiliating with ASTE.

Chairman George Bryan presided, with A. D. Esler, Program Chairman, conducting the technical session.

Obituaries

Harold S. Rounds

Harold S. Rounds, 57, a lifelong resident of Detroit and President of the Midwest Hydro Pierce Co. and Midwest Production Engineering Co., died suddenly aboard his yacht in Lake St. Clair near Detroit.

H. S. Rounds

Mr. Rounds, founder of one of the four original Detroit engineering companies, was well known among production executives.

In addition to his affiliation with Detroit Chapter, ASTE, he was a member of the Moslem Shrine and of numerous sports clubs.

C. M. Sutton

C. M. Sutton, Vice-President of McCrosky Tool Corp., recently passed away at his home in Detroit after being stricken with a heart attack.

Mr. Sutton joined the McCrosky sales force in 1911. Eight years later he became manager of the company sales office in Detroit, continuing in this capacity until the time of his death.

A member of Detroit Chapter, ASTE, Mr. Sutton was a director of Midwest Tool & Manufacturing Co. of Detroit.

Gordon P. Lundquist

Gordon P. Lundquist, Newark District Office Sales Engineer for Vascoloy-Ramet Corp., recently passed away following a heart attack.

G. P. Lundquist

During the war years, Mr. Lundquist had been associated with Wright Aeronautical Corp. of Paterson, N. J., in the Special Process Div., on the application and design of carbide cutting tools.

A member of Northern New Jersey Chapter, ASTE, Mr. Lundquist had been active in pre-organizational work towards the formation of an ASTE Chapter in the Trenton area.

Three ASTE Members Win NMTBA Offices

Quebec, Que. — Herbert H. Pease, President, New Britain-Gridley Machine Div., The New Britain Machine Co., New Britain, Conn., was elected President of The National Machine Tool Builders' Association at the organization's recent Annual Meeting in the Chateau Frontenac.

H. H. Pease

Alexander G. Bryant, Vice-President, Cleereman Machine Tool Co., Chicago, Ill., was chosen First Vice-President, and L. D. McDonald, Vice-President, The Warner & Swasey Co., Cleveland, Ohio, Second Vice-President. Louis Polk, President, The Sheffield Corp., Dayton, Ohio, was voted in as Treasurer.

H. L. Tigges

Louis Polk

Mr. Pease and Mr. Polk are members of Hartford and Dayton Chapters, ASTE, respectively.

Another ASTE'er, H. L. Tigges, Vice-President and Sales Manager, Baker Brothers, Inc., Toledo, Ohio, was elected director, along with the two vice-presidents. Mr. Tigges also serves on the ASTE National Editorial Committee.

Tell Berna continues as General Manager of the Association, and Mrs. Frida F. Selbert as Secretary.

Becomes Sales Director

Chicago, Ill. — Fred J. Schmitt has been made Director of Sales for D. A. Stuart Oil Co., manufacturers of cutting fluids and lubricants.

F. J. Schmitt

Mr. Schmitt, who has been Sales Manager of his company since 1942, is a member of the ASTE National Program Committee and First Vice-Chairman of Chicago Chapter. He has served five terms as Chapter Secretary, and was elected Second Vice-Chairman for the 1945-46 season.

Made Chief Engineer

Granby, Que.—James L. O'Neill, who recently joined the Louis J. Presson Co. as Associate Engineer, has been appointed Chief Engineer, according to an announcement by Louis J. Presson, President of the company.

During the war Mr. O'Neill was Field Supervisor for the George Scher Engineering Co. of Newark, N. J.

A member of Northern New Jersey Chapter, ASTE, he is well known in the metropolitan New York area.

Am I a Builder or a Wrecker?*

By JOHN D. REAVER

Sales Engineer, Fansteel Metallurgical Corp., St. Louis, Mo.
Member, St. Louis Chapter, ASTE

I SAW a building being torn down and stopped to watch for a while. My idle curiosity soon changed to an abrupt realization of how quickly the work was proceeding. I became deeply interested.

After closely following the activities of the workmen, I concluded that despite the rapid progress being made, nowhere was any amount of skill required.

Huge beams that been accurately fitted and ingeniously supported were sent crashing to the ground. A whole side wall fell.

I soon realized that these men, without skill, could easily wreck in a day or two what others had taken a year to build. That building represented weeks of careful planning and months of constructive effort. And behind this effort was an accumulation of knowledge and skill of high degree.

From this scene I drew an analogy of life. I asked myself—Do I live constructively or destructively? Do my actions at home, for instance, make conditions more or less pleasant for myself and for my family?

Do I perform my work constructively so as to learn and improve my efforts, or do I waste my time condemning the things I see, the people I meet, and what they say and do?

What, exactly, is my state of mind? Do I live, think and act constructively?

It was worthwhile to take stock of myself—to ask, am I a builder or a wrecker?

It seems that all my troubles—all the troubles of the world—are caused by destructive thinking, which fosters destructive acting.

I try to approach my different activities with the thought of learning, of improving, of creating or constructing. In this I progress. Life becomes sweeter—my work is more pleasant—my efforts more productive—*my fellow man more important to me.*

Participation in meetings and discussions with my fellow man has taught me the great value of constructive thinking and is helping me acquire the art for it.

To build requires knowledge and skill; tearing down is done by common labor.

So I think to myself as I go my way, which of these roles do I try to play? Am I a builder who works with care, measuring life by the rule and the square? Am I shaping my deeds to a well laid plan, patiently doing the best I can? Or am I a wrecker who walks the town, content with the labor of tearing down?

**A talk recently given before the Midtown Toastmasters Club, St. Louis, Mo.*

Foundry Operations Pictured in Color

Racine, Wis. — First meeting of the 1946-47 season for Racine Chapter was held October 7 at the Manufacturers' Association Building, with a large turnout.

After dinner Alfred Nelson, Chairman of the Chapter, introduced National Membership Chairman E. W. Dickett of Rockford Chapter, who discussed membership plans for the coming year.

As the technical feature, Russell J. Anderson, Works Manager of the Belle City Malleable Iron Co., showed colored films of foundry operations and slides picturing his company's newly completed building.

This machine was designed by Harry L. Strauss, Jr., to hot press non-ferrous metal powders

Develops Hot Press For Metal Powders

New York City—Harry L. Strauss, Jr., President of National Diamond Hone & Wheel Co., is the inventor of the first machine commercially available in the United States to hot press metal powders.

H. L. Strauss, Jr.

The machine, a laboratory model designed for testing and experimentation of metal powders, will set a standard for the tooling of hot press metal powder compacts and experimental die work.

With this press such metals as copper, tin, nickel and zinc in their powdered forms can be alloyed and hot pressed under adjustable heat and pressure conditions to produce alloy metals having a wide range of applications.

The press employs a resistance-heated carbon die which applies heat and pressure to the powdered metal simultaneously.

Mr. Strauss, designer of the machine, has been interested in metal powders for several years, originating unusually ingenious alloys. He has found many uses for titanium hydride, including its utilization in breaking down occluded oxides. While he has studied at Pratt Institute and New York University, much of his education has been of a practical nature in the manufacture of surgical instruments, diamond tools, screw machine parts and jigs and fixtures.

He is a member of ASM, ASTM, and Greater New York Chapter, ASTE.

Demonstrates Hard Facing

Decatur, Ill. — Technical topic presented at the November 11 dinner meeting of Decatur Chapter, held in the Decatur Club, was "Hard Facing of New Tools and Its Use in Tool Repair," with Chester Mott, Metallurgist of Fansteel Metallurgical Corp., Chicago, as speaker.

After Mr. Mott's talk, the group adjourned to the nearby Starr Chrysler Garage where Mr. Mott demonstrated hard facing methods.

* * *

At the previous meeting, Harry Coopland, Special Representative of Jack & Heintz, Inc., Cleveland, Ohio, delivered his lecture, "Seeing Is Believing," concerning the practicability of the Golden Rule in industry.

The attendance of 65 included visitors from surrounding communities.

Coming MEETINGS

ALL CHAPTERS—February. Election of Chapter officers, Delegates and Alternates.

BOSTON — February 13, 6:30 P.M., Schrafft's Restaurant. Speaker: C. E. Stubbs, Senior Partner, Henry A. Loudon Advertising, Boston, Mass. Subject: "Why Should Industrial Design Interest the Tool Engineer?"

CEDAR RAPIDS—January 15, 6:30 P.M., Montrose Hotel. Speaker: Clare Bryan, Consulting Tool Eng., Link-Belt Co., Chicago, Ill. Subject: "Practical Engineering of Jigs and Fixtures."

CENTRAL PENNA. — January 14. Time and place to be announced. Speaker: H. E. Conrad, Executive Secy., ASTE. Subject: "Objectives of ASTE and General Chapter Activities."

CINCINNATI—January 14, 6:30 P.M., Cincinnati Engineering Society. Speaker: R. E. Frederick, International Business Machines Corp., Endicott, N. Y. Subject: "Tool Engineering for Safety." February 11. Same time and place. Speaker: J. O. Almen, Head of Mechanical Eng., No. 1, General Motors Research Laboratories, Detroit, Mich.

CLEVELAND — February 14. National President's Night, honoring A. M. Sargent, ASTE President. Speaker: James Y. Scott, President, Van Norman Co., Springfield, Mass.

DAYTON—January 13. Dinner 6:30 P.M. Visit to National Supply Co., Springfield, Ohio.

DECATUR—January 13, 6:30 P.M., Decatur Club. Speaker: Robert Christison, Cost Control Mgr., Oakes Products Co., Decatur, Ill. Subject: "Time Study in Industry." Also FBI film, "Know Your Money." February 10. Same time and place. Speaker from Elgin Watch Co., Elgin, Ill. Subject: "Manufacture of Jewel Bearings."

ELMIRA—February 3, 7:00 P.M., Mark Twain Hotel. Speaker: A. W. Meyer, Asst. Director of Design, Brown & Sharpe Co., Providence, R. I. Subject: "Tooling for Automatics."

ERIE — February 4. Speaker: W. P. Powers, U. S. Tool Co., Inc., Ampere, N. J. Subject: "High Production Forming and Piercing of Intricate Metal Parts Without Expensive Dies."

FLINT—January 16, 6:30 P.M., General Motors Institute. Speaker: Norman Iverson, Chief Eng., Michigan Broach Co., Detroit, Mich. Subject: "Broach Design and Practical Production Broaching." February 20. Subject: "A New Concept of Mass Production."

GOLDEN GATE—January 15, 6:00 P.M., City Club Hotel, Oakland, Calif. Speaker: Clare Bryan, Consulting Tool Eng., Link-Belt Co., Chicago, Ill. Subject: "Practical Engineering of Jigs and Fixtures." A. M. Sargent, ASTE President, will be guest. February 3. Speaker: Philip M. McKenna, President, Kennametal, Inc., Latrobe, Pa. Subject: "Kennametal."

HAMILTON — February 14, 7:00 P.M., Kirby House, Brantford, Ont. Speaker: Harold B. Chambers, Chief Metallurgist, Atlas Steels, Ltd., Welland, Ont. Subject: "Tool Steels for Blanking and Forming."

HOUSTON—March 19-22. Annual Meeting, ASTE.

LITTLE RHODY — January 15. Speaker: L. R. Twyman, Mgr., Industrial Div., Vickers, Inc., Detroit, Mich. Subject: "Hydraulics.' February 19. Speaker: A. H. Moore. Subject: "Electronics."

LOUISVILLE—January 14. Speaker: John A. Koch, Carpenter Steel Co., Reading, Pa. Subject: "Design and Proper Application of Steel."

MILWAUKEE — February 13. Speaker from George Gorton Machine Co., Racine, Wis. Subject: "Exact Duplicate."

NASHVILLE—January 17. Speaker: I. C. Thomasson. Subject: "Electrical Engineering." February. Subject: "Tooling and Costs."

PHILADELPHIA — January 16. Carbide Symposium. Speakers to be announced. February 20. Brill Night. Speaker: Clarence H. Hopper, Gen. Supt., J. G. Brill Co., Philadelphia. Subject: "Competitive Motor Coach Manufacture."

ROCHESTER — January 15, 8:00 P.M., Rochester Institute of Technology. Speaker: R. R. Rhodehamel, General Sales Mgr., National Acme Co., Cleveland, Ohio. Subject: "Tooling Multiple Spindle Automatic Bar and Chucking Machines for Higher Production."

SYRACUSE — January 14, 8:00 P.M., Hiawatha Room, Onondaga Hotel. Speakers and subjects: R. P. Esser, "Industrial Hydraulics"; Lester Speickhoff, "The Mosley Floating Die Holder." February 11. Same time and place. Speaker: R. G. McElwee, Vanadium Corp. of America, New York City. Subject: "New Developments in Cast Iron."

TOLEDO — February 12, Toledo Yacht Club. Valentine Party, buffet lunch, dancing, entertainment.

TORONTO—January 13. Speaker: A. W. Meyer, Asst. Director of Design, Brown & Sharpe Mfg. Co., Providence, R. I. Subject: "Trends in Machine and Tool Design." February 10. Executives Night. Speaker: O. W. Winter, Chm., National Education Committee, ASTE. Subject: "Tool Engineering Education."

Snyder Names Melling Chief Engineer

Detroit, Mich. — George D. Melling, Jr., has been appointed Chief Engineer of Snyder Tool & Engineering Co., according to an announcement by Clarence Snyder, company President.

G. D. Melling, Jr.

With Snyder since 1935, Mr. Melling has, in recent years, specialized in sales engineering.

Earlier he was associated with his father in the machinery business, with Kelvinator Corp. and Buick Motor Co. His work has brought him into first-hand contact with practically every type of problem in process engineering and with production procedures in many industries. He is an ASTE member, affiliated with Detroit Chapter.

Describes Safety Devices

Rochester, N. Y.—Joseph I. Karash, Plant and Process Engineer for the Reliance Electric and Engineering Co., Cleveland, Ohio, was the technical speaker at a meeting of Rochester Chapter, October 16, in Rochester Institute of Technology.

J. I. Karash

Mr. Karash lectured on "Design of Dies for Inclinable Presses," supplementing his talk with slide pictures and drawings.

In dealing with the problem of safety in press operation, the speaker described devices for protecting the operator.

By screen projection of line drawings depicting various features of die design, he showed how pieces may be stamped, ejected and sorted by means of the proper-sized holes in the discharge incline.

Mr. Karash, who is the author of "Analysis of Drill Jig Design," advocated inclining the press as much as 45 degrees, also advising the use of adjustable speed motors or controls to regulate press speed for most efficient operation.

At the request of Chairman Charles Seely, Mr. Karash, a former Chairman of Cleveland Chapter, presented to Earle W. DeBisschop the Chapter's gift of a Past Chairman pin.

Approximately 130 members and guests were present at the meeting.

Plant Shows Diecasting On Automatic Machines

Portland, Ore.—Through an effective combination of lecture, film visualization, and inspection of actual factory operations, 40 members and guests of Portland Chapter learned the "Economics of Tooling and Production by the Diecasting Process."

The technical program, following a recent dinner meeting in the Congress Hotel, was introduced with the showing of a Kodachrome film, "Diecasting," presented through the courtesy of the New Jersey Zinc Co.

After the motion picture was screened, W. E. Brennan, Program Chairman, presented the speaker of the evening, Ralph D. McGilvra, President and Chief Engineer of Production Engineering Co., and a Chapter member.

At the conclusion of his very informative talk, the speaker exhibited many intricate examples of diecasting.

The group then adjourned to Mr. McGilvra's plant where they saw automatic diecasting machines turning out castings of zinc alloy, and ladle-fed machines producing aluminum parts.

The visitors found the session highly educational, since the diecasting industry is new on the West Coast and the McGilvra plant one of the latest constructions in Portland.

Wesson Elected Director

Springfield, Mass.—Daniel B. Wesson, Research Engineer at Smith & Wesson, Inc., was elected a director of the company in the recent annual stockholders' meeting.

Mr. Wesson is Secretary of Springfield Chapter, ASTE.

Builders of A. S. T. E.

Otto W. Winter, President, 1942-1943

By O. B. JONES, *Society Historian*

OTTO WINTER, Vice-President of Acme Pattern & Machine Co., Buffalo, N. Y., was the eleventh President of the American Society of Tool Engineers.

O. B. Jones

His engineering training at the Ohio State University under the late John Younger, followed by his executive experience in engineering and plant management, amply qualified him for this exacting position.

The Society has always recognized his ability, and from its inception has given him important assignments. Otto is the long-time Chairman of the Society's National Education Committee. His term in the presidency, during 1942-43, came in the midst of the world's biggest tooling program.

Implements War of Machines

"The tool engineer," Otto reminisces, "was experiencing his trial by fire during this period when our country was entering upon the greatest war in its history—a war of machines whose outcome in those dark days was extremely doubtful. Consciously or unconsciously, he was the key man, the savior of the nation. According to the War Manpower Commission, 50 of him were needed for every one available.

"As most of us were working day and night, seven days a week, little time or energy remained for Society activities; for the promotion of our all-important professional program. Yet it was a day of golden opportunity for the tool engineer, so shortly before condemned to the economic 'doghouse,' misunderstood and unrecognized."

The Society's Fact Finding Committee, through its Chairman, the late John W. Younger, had recently given its third and final report on its assignment to determine whether tool engineers were the cause of the existing prewar unemployment and unrest, or whether they were the cornerstone of our material civilization.

Restrictive Legislation Checked

"As expected by most," says Otto, "the Committee vindicated our continued existence. Their findings were an answer to the crackpot legislation being enacted to tax prohibitively the use of labor-saving machinery—an economic retrogression which, unchecked, could have doomed the tool engineer and the nation.

"But checked it was and in time, whether by ASTE's efforts, by the war, or both. 'Tooling up' was suddenly the most important theme of the day. Overnight 'machine tool' became almost a common household term.

"Pushed onto the stage under the spotlight, the tool engineer turned in a top performance. History records the magnificent job he did, and leaders of our armed forces have expressed their appreciation unstintingly."

Sensing that this was the psychological moment for which it had been waiting, the Society seized the opportunity to gain industrial and public recognition.

"Our theme, 'Pass along the "know-how,"' " enthuses Past President Winter, not only kept overworked ASTE'ers active in Society affairs, but also sparked the biggest and best publicity campaign that ASTE had ever projected, under the direction of Athel Denham, publicity agent, and 'Ade' Potter, who had just been appointed Executive Secretary.

"Our convention at St. Louis in the spring of '42, when I advanced to the presidency, was a significant event. With technical sessions jam-packed, radio programs, publicity galore, and Rear Admiral Downs as our banquet speaker, we were well on our way to 'know how' and be known."

Cooperative Administration

With a loyal and capable Executive Committee, a "reasonably understanding and supporting" Board of Directors, and a new Executive Secretary at the helm in the National Office after a year's interim following the illness and death of the beloved Ford Lamb, the Society was able to accomplish some things and begin others that succeeding administrations have developed and brought to completion.

"To make more effective our contribution to the war effort," explains Otto, "we attempted a tool engineering talent survey. In many Chapter cities this served to instrument and staff war production advisory councils and to assist war plants that found themselves in strange fields, making unfamiliar items fraught with many perplexing problems.

Inaugurates Area Setup

A significant change in ASTE structure and organization, initiated during Otto's term and still retained in modified form, was the area setup. This plan consisted in dividing the U. S. and Canada into several general sections for better co-ordination between the national administration, local Chapters and individual members.

"Area meetings of Chapter officers, National Directors, and committeemen, preceding each of our National Meetings, still serve to guide the Board of Directors and the House of Delegates," points out the former President. "The more opportunity the individual member has to express his desires and needs, the more valuable we can make his membership.

"Another innovation was the monthly editorial in *The Tool Engineer* by the Society President, a feature which has been continued and improved upon by succeeding Presidents."

Government Commends Program

Breaking all previous records for technical session attendance, the Semi-Annual Meeting at Springfield, Mass., in the fall of that year, won the approval and commendation of officials in the government and armed forces. Everyone present gained new knowledge about producing the tools of war. Exhibits demonstrated the techniques described. Public recognition of the service rendered by the tool engineer came from Thomas H. Beck, President of the Crowell-Collier Publishing Co., who addressed the banquet.

"An important issue that had been debated since the St. Louis meeting," Otto recalls, "was the question of holding an Exposition at the Annual Meeting scheduled for Milwaukee the following March. In January of '43, the Board of Directors decided in the affirmative, by mail ballot. Two months later our show opened, a magnificent achievement on the part of 'Ade' Potter, the headquarters staff, 'Larry' Radermacher and his Milwaukee committees, and Athel Denham on the publicity end.

Wartime Show Thronged

"Its title, 'War Production Edition of the ASTE Machine and Tool Progress Exhibition,' and its theme, 'Here's How to Know How,' clicked and attracted an attendance that amazed us. Technical sessions were more heavily attended than ever before; exhibit space was an early sell-out with many companies turned away; and interest ran at an all-time high.

O. W. Winter

"Truly the tool engineer wanted to 'learn how.' The government nodded approval, and military exhibits, as well as brass and gold braid, were in eminence. Gen. H. F. Safford, Chief of Production, Office of the Chief of Ordnance at Washington, paid us a glowing tribute at the banquet. . . . The tool engineer was really 'in the groove.' "

But while these great national meetings proved highlight milestones, there was plenty of Society activity nationally, locally, and individually. ASTE'ers throughout the country were spending many extracurricular hours teaching those enrolled in the Engineering-Science-Management War Training Program of the government.

The Society was also very effectively engaged in the publishing and distribution of war training material, notably the New York State Education Department monographs that have proved so valuable.

Degree Courses Promoted

"While war training constituted our main educational effort," adds Otto, "groundwork was continued on our post-war and long term program to install tool engineering courses and degrees in accredited engineering schools.

"As every ASTE President thinks when his brief term of office expires, there is 'so much to do, so little time in which to do it.' The enormity of our untouched work assures an ample field for expression and opportunity for accomplishment by future administrations.

"Progress of ASTE in the past has been great; the rate of future advancement in our professional program is wholly dependent on the perspective of our leaders and the cooperation and support of the membership.

"Tool engineering is today recognized by many important people as a separate and distinct branch of the engineering profession. The tool engineer has earned a place in the professional sun," declares Otto.

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

HAMMOND MACHINERY BUILDERS, INC., 1600 Douglas Ave., Kalamazoo 54, Mich., has issued an 8-page *Bulletin 310*, featuring their No. 5 Abrasive Belt Grinder-Polisher with horizontal platen; Model F-2 Flexible Belt Grinder; and Model VH-6 Abrasive Belt Grinder, for grinding, polishing and similar operations on metal, plastics, ceramics, glass, and other materials.

H. E. DICKERMAN MFG. CO., 321 Albany St., Springfield, Mass., has a folder available, *Dickerman Hitch Feeds*, explaining how their 2" and 4" hitch feeds make for accurate, economical punch press production.

RAYCO MFG. CO., 3911 So. Prairie, Chicago 15, has a new folder, *Rayco High Speed Quick Change Chuck*, describing how tool changes can be effected in 3 seconds—by use of the Rayco chuck—on electric drill, drill press, or flexible shaft equipment.

MARVEL ENG'G CO., 69 W. Washington St., Chicago, has released *Bulletin No. 102*, describing their new Marvel Synclinal 3-in-1 Filter, claimed to have three times the filtering area of conventional units. Non-rusting, with no moving parts, it can be installed on any type machine which uses circulated oil for coolant or hydraulic systems.

TOCCO DIV'N, Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland 1, has available a 59-page booklet, *Induction Heating*, authored by H. B. Osborn, Jr., Director of Research for Tocco, covering the history, principles, technical considerations and noteworthy applications of induction heating for commercial use.

SAPPHIRE PRODUCTS DIV'N, Elgin Nat'l Watch Co., Aurora, Ill., has available a pamphlet on *The Uses of Sapphire*, describing the characteristics of sapphire, and how it cuts costs when employed as a production tool.

MONARCH MACHINE TOOL CO., Sidney, Ohio, has available a 36-page *Bulletin No. 1701*, describing the Uni-Matic lathe. It emphasizes the many machining setups possible with the Uni-Mats—individually motor-operated tool slides—with which the versatile turning machine is equipped.

REPUBLIC DRILL & TOOL CO., 322 S. Green St., Chicago 7, has released *Bulletin RM-1*, describing their new mechanics length high speed drills which are 15% shorter than equivalent sizes of jobbers length drills. Available in fractional sizes from 1/16" to ½" dia. and wire gauge sizes from No. 1 through No. 34, it is claimed the shorter flute length results in less vibration and greater drill life.

KERR MFG CO., 6081 12th St., Detroit 8, has two booklets available: *Industrial Precision Casting Equipment & Materials*, and *Industrial Precision Casting* — the latter explaining the "lost wax" method of precision casting.

SUPER TOOL CO., 21650 Hoover, Detroit, has a folder, *Solid Carbide & Carbide Tipped Twist Drills*, recommending solid carbide drills for use on such materials as plastics and non-ferrous metals. Tipped drills, developed some time ago, are now stocked in a substantial number of sizes.

BELLOWS SENACON CO., 798 N. Main St., Akron 10, Ohio, has available a folder, *Bellows Air Motors*, which defines their products as "small, compact, air-driven, double-acting, reciprocating power units" for operations involving pulling, pushing or lifting, utilizing air line pressures up to 175 pounds. Also available are eight *Foto Facts File Sheets* —case histories showing the effective use of controlled-air power in speeding production.

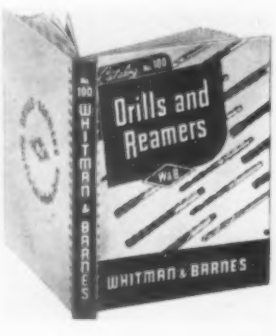
DANLY MACHINE SPECIALTIES, INC., 2100 S. 52nd Ave., Chicago 50, has released a *Dowel Pin Drill & Reamer Chart*, size 6¼" x 10", containing drilling and reaming instructions for dowelling in cast iron and steel.

VERSON ALLSTEEL PRESS CO., 1355 E. 93rd St., Chicago 19, has available a 64-page *Catalog No. E-44*, describing their punching-stamping and drawing presses. There is abundant technical data on blanking, drawing and forging, as well as on press lubrication, installation, and maintenance. Special presses that are described include a Verson Press Brake capable of bending ⅝" steel plate 33 feet long to a 90° angle at one stroke.

WAR ASSETS ADMINISTRATION, 2nd Floor, Buhl Bldg., Detroit 26 (or any other WAA office) has available a 12-page folder, *Your Guide to Surplus Property*, for veterans interested in the purchase of war surplus goods.

VASCOLOY-RAMET CORP'N, North Chicago, Ill., has released a 32-page carbide technical *Catalogue VR-400*, describing nearly 500 standard tools and blanks, many of which are listed for the first time.

WHITMAN & BARNES, Div'n of United Drill & Tool Corp'n, 2108 W. Fort St., Detroit 16, has a new 202-page *Catalog No. 100*, listing their line of drills—fractional, wire gauge, letter and metric sizes; also drill sets, countersinks, reamers, and much technical data. Also available is a circular called, *Carbide Tipped Masonry Drills*.

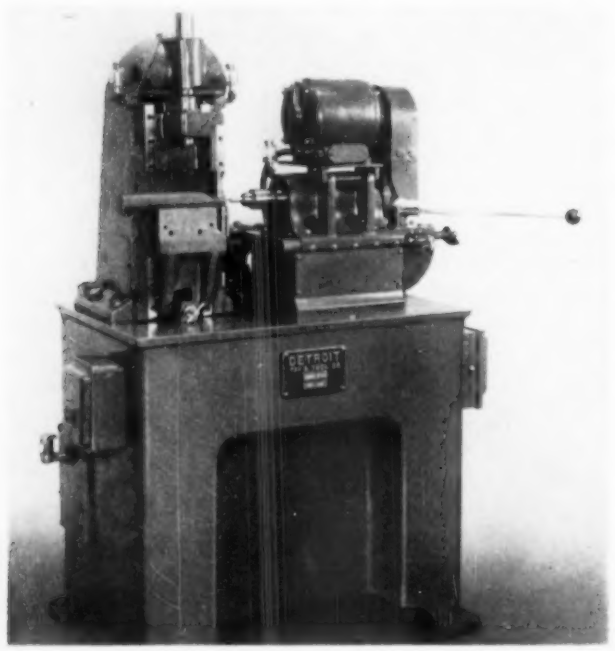


TOOLS OF TODAY

Center Drilling Machine

A HIGH PRODUCTION **CENTER DRILLING MACHINE**, with automatic centering and clamping, is now available from *Detroit Tap & Tool Co.*, 8432 Butler Ave., Detroit 11. Operation of the machine is extremely simple, requiring such a minimum of skill that "green" operators can do concentric centering on a wide range of stock sizes.

The machine will handle a wide range of shapes and sizes. Concentric centers may be drilled in round, square or polyon, stock ranging from $\frac{1}{8}$ to $2\frac{3}{8}$ inches outside diameter. Length of stock is limited only by convenience in handling, and output is said to be materially higher, per machine hour, compared with conventional equipment.



A self-centering vise automatically clamps the work in concentric alignment with the centering drill. The vise is actuated by an hydraulic cylinder, controlled by a three-way valve actuated by an extension of the drill head feed lever. Two racks—one of which is integral with the hydraulic cylinder plunger rod—mate with a fixed pinion to transmit opposed vertical motion of exactly equal amounts to the upper and lower V-block jaws of the vise.

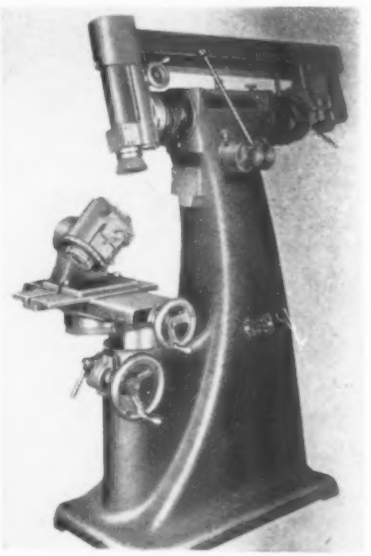
The drill head is of the cartridge type with high precision ball bearings, and travels on hardened and ground adjustable ball bearing ways. Three speeds—1250, 2400, or 5200 rpm—are obtained through a V-belt step pulley drive from the spindle drive motor. Another motor drives the gear type hydraulic pump through a flexible connection.

Price Reduction Announced

NEW REDUCED PRICES for **CARBIDE TIPPED MASONRY DRILLS** are announced by *Super Tool Company*, 21650 Hoover Rd., Detroit 13, manufacturers of the Super line of carbide tipped and solid inserted blade cutting tools. Lower production costs following increasing sales are named as reasons for the price reduction.

Heavy Duty Cutter Grinder

THE HEAVY DUTY **ACE TOOL AND CUTTER GRINDER**, by the *Oliver Instrument Company* of Adrian, Michigan, is an adaptation of the standard Oliver Ace Tool and Cutter Grinder intended for the heavier work of gumming and gashing cutters and for use in grinding cutters tipped with Tungsten-Carbide. Retaining all the desirable qualities of the previous machine, it is equipped with a much heavier ram, larger ram bearing, a heavier motor and a heavier spindle. The frame has also been increased in weight, to insure vibrationless grinding.



Being sufficiently heavy for the most rugged grinding, the same type of fixtures are used on this machine as on the standard Ace. In addition, the new machine has such exclusive features as: A fixed diamond which compensates for the wear of the wheel; a means for grinding eccentric relief on milling cutters and reamers; correct clearance obtained by direct reading—no computations or tables; grinding on the top tooth of the cutter in full view of the operator; comfortable standing position of operator; no special attachments needed for grinding all regular (and many special) milling cutters, or for the grinding of Tungsten-Carbide in its many forms.

New Heavy Duty Vise

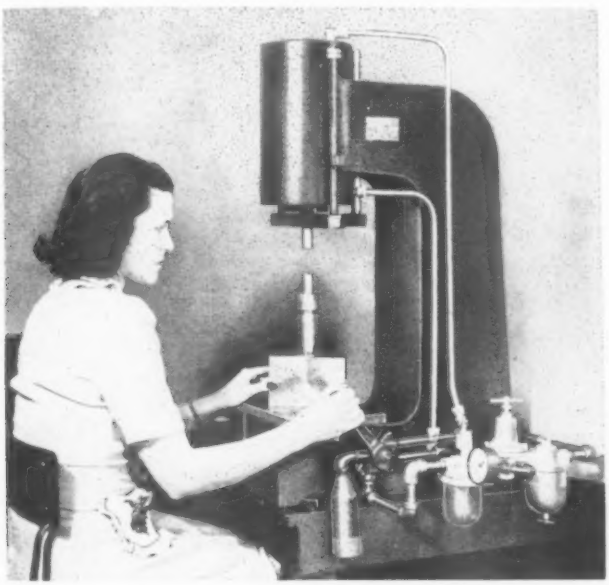
NAMED THE GRAND **VISE MASTER**, a general utility speed vise, claimed to incorporate many outstanding advantages not found in conventional types of machinists' vises, is announced by *Grand Specialties Co.*, Grand Ave. at Troy St., Chicago 22. This new tool is described as closing instantly with a push on the free jaw (eliminating the time and motion required for running in with handle), and opening automatically by trigger release on its spring action, features previously found only in the smaller Quikcet Vise manufactured by the same company.

Among other features, this heavy duty speed vise is equipped with "Double Bite" steel pipe jaws, which are integral with the body, to eliminate time required to adjust loose jaws to pipe or tubing, also, it completely revolves full 360° on base with double swivel, friction type, lock-up which fastens from both sides and securely holds the desired swivel position.

Air Powered Arbor Presses

TWO NEW AIR POWERED, all steel welded construction **ARBOR PRESSES**—the Hurricane Six and the Hurricane Eight—are announced by the *Studebaker Machine Company*, 1221 S. 9th Ave., Maywood, Ill.

Double acting air cylinders are used on both models. The Hurricane Six develops one ton ram pressure, on the down and up strokes at 80 lbs. air line pressure and one ton on the up stroke, and the Hurricane Eight develops two tons ram pressure on the down and up strokes at 80 lbs. air line pressure. At 120 lbs. pressure, ram pressures increase 50 per cent.



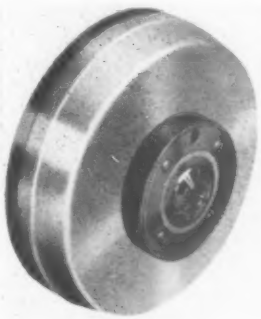
Special Collet Fixture

A SPECIALLY DESIGNED **COLLET FIXTURE,** by *Zagar Tool, Inc.*, 23880 Lakeland Blvd., Cleveland 17, greatly increases the usefulness and production of a standard plain grinding machine. Used to grind parts without centers, which can be held in collets, this tool runs on its own ball bearings and is driven by the headstock of the machine. The collet, with maximum capacity of 2 inches, can be opened and closed while the grinder is running. Because the collet does not move lengthwise, it is possible to hold overall dimensions.

Easily adaptable to any make or model of grinder, this Zagar Collet Tool is quickly installed or removed and its use involves no extra or special attachments. The illustration shows the fixture in operation, grinding the eccentric of a crank for a Zagar multi-drill head.

Almco Jet-Type Collet Chuck

A NEW TYPE of close coupled collet chuck—the **ALMCO JET-TYPE COLLET CHUCK,** by *Modern Collet & Machine Co.*, 401 Salliotte St., Ecorse 18, Mich., embodies an entirely new operating principle and offers the following advantages: Gripping pressure of the collet is adjustable, in 12 positive steps, from zero to 15,000 lbs. Thus, thin-walled tubing can be held without distortion, and bar stock is held without slippage for hogging cuts up to the full horsepower of the machine.



The collet is closed by spring action with positive, uniform force, and is opened by a compressed air jet (100 p.s.i. line pressure); therefore, the chuck cannot open in case of failing air pressure. There is no contact between the air nozzle and the chuck—hence no wear, and the chuck can be opened in any position whether stationary or up to maximum speed.

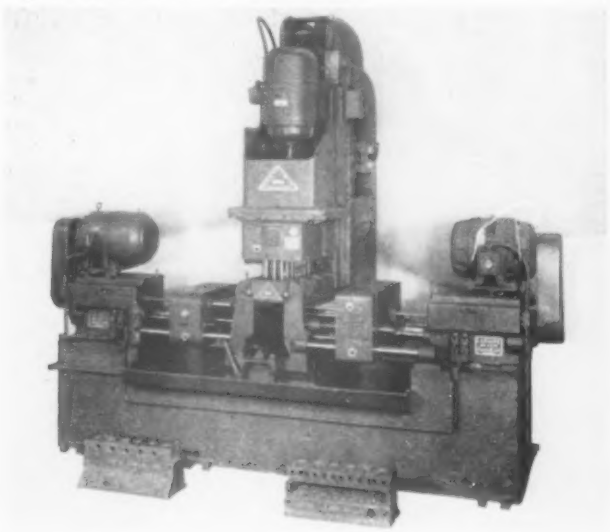
The collet is positively positioned in the chuck, and cannot loosen or change adjustment with rotation in either direction. Collets are quickly changed from the front of the chuck, and are available in all sizes to 1" maximum, round, hex and square.

Used on lathes and hand screw machines, the over-all length of the chuck, including collet, is 2¾". Weight is 11½ lb. Chucks of larger sizes, as well as indexing bases for use with second-operation work, are in process of development.

3-Way Drilling Machine

A 3-WAY **DRILLING MACHINE,** by *LeMaire Tool & Manufacturing Co.*, 2657 So. Telegraph Rd., Dearborn, Mich., is designed to drill 34 holes top, 19 holes right and 10 holes left side of cylinder blocks. The machine consists of LeMaire No. 5000 Twin Ram Units, with multi-spindles, mounted at each end of a one-piece rigidly fabricated base, and a LeMaire No. 20 slide type hydraulic drilling machine, less table and base, mounted at the rear.

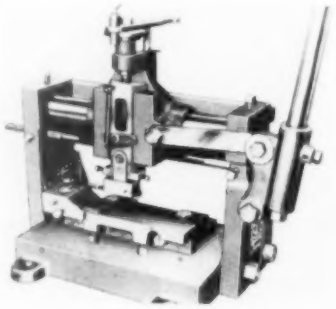
The fixture is of tunnel type, incorporating all drill bushings, and the part is slid into the fixture on wear strips and guided by the crank base to an approximate stop. Manually operated, retractable pins are then engaged with the locating holes and the part is held over both sides of the top by hand operated cam locking toe clamps. Production rate is approximately 60 pieces per hour at 100% efficiency, allowing 30 seconds for load and unload.



Bench Marking Machine

MANUFACTURED BY *Edward Pryor & Son, Ltd.*, Sheffield, England, and exclusively marketed in the United States by *Wm. A. Force & Co.*, 216 Nichols Ave., Brooklyn 8, N. Y., a **BENCH MARKING MACHINE**—known as Model E. P. 1—is hand operated and readily tooled for marking pieces of varied sizes and shapes.

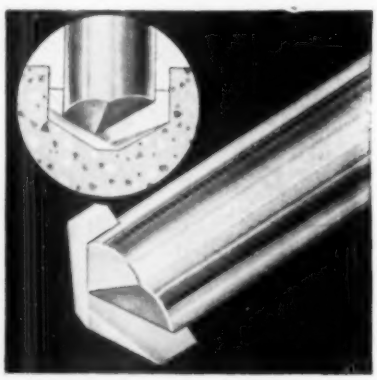
Both flat and cylindrical work can be marked on either the top of a small angle plate, or directly on the machine base plate. A hand lever draws the carriage, to which the marking die is attached, along a round slide bar. Where the work may be slightly tapered from front to back, jack screws provide an easy adjustment. The length of inscription made, by the machine, depends on the depth of impression required, the kind of material and the size of the characters. Generally, 2 inches on steel and 3 inches on brass are the outside limits.



K-M Drills for Concrete

Kennametal, Inc., Latrobe, Pa., now has available a line of **KENNA-DRILLS** for rotary drilling in concrete, brick, slate, marble, glazed tile and the general run of non-metallic construction materials. The cemented carbide tips, much harder than tool steel, resist the abrasion of these materials and permit rotary drilling at highly satisfactory speeds. Any air or electric drill may be used, or, should it be desired to drill parts in quantity, a drill press may be used.

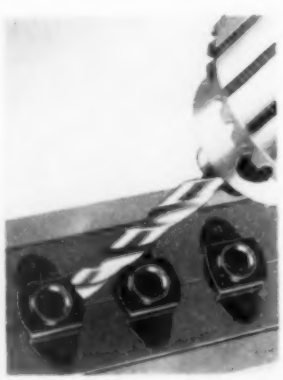
Because of the strength of the K-M carbide used, the drills have been designed with extended lips, thereby providing clearance and easier ejection of chips. The drills may be readily sharpened. Nine sizes are currently available, ranging from ¼" to 1".



New Drill Jig Bushing

A NEW TYPE OF **DRILL JIG BUSHING**—called "Anchor-Bushing" — recently introduced by *Hi-Shear Rivet Co.*, 1559 Sepulveda Blvd., Hermosa Beach, Cal., is claimed to effect a saving, in man-hours, up to 75 per cent on lofting and tool making.

The bushing, of hardened steel, is pressed into a formed steel anchor which can be quickly spot-welded to any flat or curved template. A heavy fixture is not required, and the bushing is equally adapted for small run lots or for precision drilling on mass production job. Literature on request.



Carboloy Masonry Drills

THE IMPROVED LINE of Carboloy **MASONRY DRILLS**, by *Carboloy Company, Inc.*, Detroit, Michigan, now includes 15 sizes, ranging from 3/16" to 1½" nominal diameter (sufficient over-size allowances are provided for proper hole size required for installation of such devices as expansion shields, anchors, and toggle bolts). Due to increased demand, with consequent increase in production, price on each drill size has been reduced some 40% below previous levels.

The improved drill design features a solid round shank, without flutes, which gives greater strength and maximum possible support to the Carboloy cemented carbide cutting tip. According to controlled tests and users' reports, the new round shank actually gets dust out of the drilled holes better than the former fluted design.

New Electric Furnace

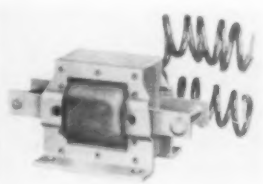
A NEW **ELECTRIC FURNACE**, said to offer a performance unusual for a furnace of its size and moderate cost, is announced by the *Thermo Electric Mfg. Co.*, Dubuque, Iowa. Known as the Model CEA, this new furnace offers wider utility for general laboratory use and for production heat-treating of small parts.

The heating chamber measures 4¾" wide, 4¼" high and 6" deep, with overall dimensions of 12" wide, 15½" high and 14½" deep. The fact that the furnace will maintain a temperature of 2000° F. continuously, and automatically hold any selected temperature from 500° F. to 2000° F. should considerably increase its scope. The manufacturer particularly emphasizes the fast heating of this Model CEA—up to 1500° F. in 30 minutes.

Midget Size Solenoid

A MIDGET SIZE **SOLENOID**, by the *John S. Barnes Corporation*, Rockford, Ill., is engineered for long life and trouble-free, dependable service. Hammering action is said to have been completely eliminated, and specially treated coils are unaffected by oil or coolant.

Rigidity, with resultant greater strength, is provided by extra heavy feet integral with the side plates, while phosphor bronze plunger guides offer better bearing surfaces. Finally, the compact design makes this small solenoid easily adaptable to most applications, the while insuring economy both in space and operating cost.



Hub Disc Wheels

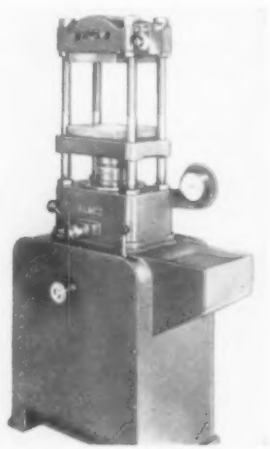
BAYFLEX RAISED HUB **DISC WHEELS**, manufactured by *Bay State Abrasive Products Company*, Westboro, Massachusetts, are said to represent a distinctly new type of abrasive wheels. Outwearing abrasive coated discs, they have a widespread application—especially in the field of welded or brazed metals—and have already found marked acceptance in foundries, sheet metal shops, automobile and truck body repairing shops, and welding shops. They are also valuable in grinding aluminum castings.

One definite advantage is that the edge can be used for grinding and even cutting off, which is impossible with abrasive coated discs. Unlike ordinary coated discs, Bayflex discs can be used efficiently right down to the nut; consequently, they outwear the other type many times. Under normal circumstances these wheels are not subject to "loading"; however, on the rare occasions when lead or paint might tend to loading, the wheel can be quickly cleaned by touching the face on a concrete floor.

These wheels will fit any standard machine formerly employing coated discs, and are available in the same grit size. Illustrated descriptive folder outlining the advantages of these new wheels, may be had on request.

New Air-Hydraulic Press

A COMPLETE NEW LINE of high-production, fully power-operated, **HYDRAULIC PRESSES** that have neither motor nor pump is announced by *Elmes Engineering Works*, of American Steel Foundries, 1002 Fulton St., Chicago 7.



Compressed air from the shop line, introduced above the liquid by a simplified control, provides the power for rapid closure and instantaneous full pressure and applies and maintains any desired pressure within capacity range. This novel hydraulic application promises greater economies in the molding of plastics and rubber, in assembly forcing, straightening and testing. Simple design, negligible air requirements, as well as low first cost, operation, and maintenance, are combined in lightweight, compact press construction. Available in 20- and 30-ton bench-type and floor-type models, and in 50-ton floor-type. The 30-ton floor-type, shown, has 6" stroke; opening adjustable from 0" to 13"; and can be equipped with 10" x 10" hot plates.

Two Stage Air Compressors

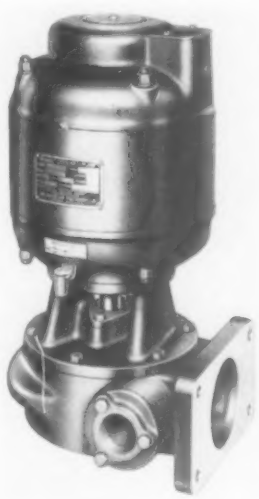
FIVE NEW MODELS of Super-Duty **TWO-STAGE AIR COMPRESSORS** are announced by *Motor Generator Corp'n*, a division of The Hobart Brothers Company, Troy, Ohio. Available in 7, 9, 13 and 21 cubic foot capacities, these compressors will be furnished with 80-gallon storage tanks, or (optional) a 60-gallon tank may be had with the 7 cubic foot unit.

The compressors are self contained, with motor and compressor mounted on a one-piece steel sub-base which, in turn, is electrically welded to the horizontal air receiver. They are fully automatic and controlled by centrifugal type unloading valves which guarantee against motor burn-out. Air pressure is automatically controlled, the pressure switch contacts closing at minimum and opening at maximum air requirements.

Increased radiating surface, for cylinders and cylinder heads, is provided by integrally cast fins for dissipating the heat generated during compression of the air. In addition, a fan type flywheel circulates the air past a copper finned intercooler (fins drawn right in the copper thus giving one-third greater radiating surface) and further cools the air as it passes from the low pressure cylinder to the high pressure cylinder. This minimizes the collection of carbon in the valves and insures greater efficiency of compressor.

Motor Driven Pump

A NEW BALL BEARING **MOTOR DRIVEN PUMP**, by *The Ruthman Machinery Company*, Cincinnati 2, Ohio, is capable of handling 70 gallons of liquid per minute at a total head of 22 feet equipped with ¾ hp, 1725 rpm motor.



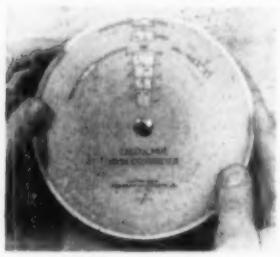
This pump, called Model 2-C, can be installed either below or above the reservoir, in a horizontal or vertical position. When desired, it can be converted to pipe inlet type by use of a pipe adapter plate available in several sizes. Other similar models will be available from ¼ hp to 2 hp inclusive.

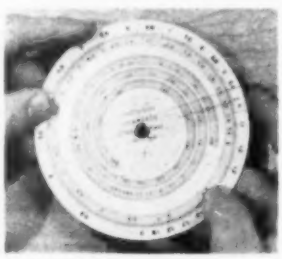
The trade mark "RUMAC" will be used to identify this new line of pumps to distinguish them from the Ruthman "Gusher" Pumps widely known throughout industry.

"Calculaide" Slide Rule

Only 4½" in diameter, the simplified Calculaide Commerce **SLIDE RULE,** by *American Hydromath Company,* New York City, combines pocket size convenience with the precision of a 12" slide rule. Incorporating many advantages over conventional "slip sticks" and circular slide rules, contrasting colors, on the scales, assure easy reading and aid in remembering variables on the several scales. Accuracy is enhanced by locating the most used scales close to the edge, so that each is actually 12½" long.

The rule carries the usual C and D scales, plus a log-log scale ranging from 1.01 to 100, which appears as an inner spiral of almost three turns and which is conveniently arranged for computing, in one setting, both compound interest problems and numerous engineering problems.

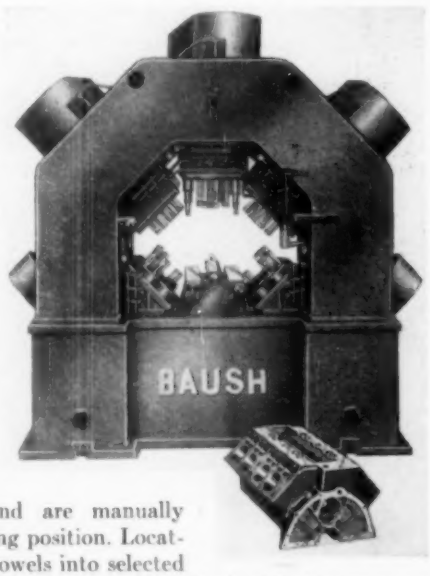




Also, by American Hydromath a new **CALCULAIDE INCH** and **MILLIMETER CONVERTER,** in which fractions of an inch are instantly converted into decimals or millimeters, or vice versa. Also, corresponding U. S. standard gage numbers and drill numbers are revealed. This calculator is only 5¾" in diameter, yet, decimal equivalents are graduated to .001 inch, with accuracy to .0002" easily estimated. Likewise, metric equivalents are graduated to .1 mm and can be estimated to .01 mm. Range is from 0 to 100 mm. In addition, U. S. standard gages from No. 3 to No. 30, and drill numbers from No. 1 to No. 60 are also shown. Both calculators are made from tough, non-warping, non-inflammable plastic which is unaffected by moisture, perspiration or ink, and both may be cleaned with a damp cloth.

Baush 5-way Tapper

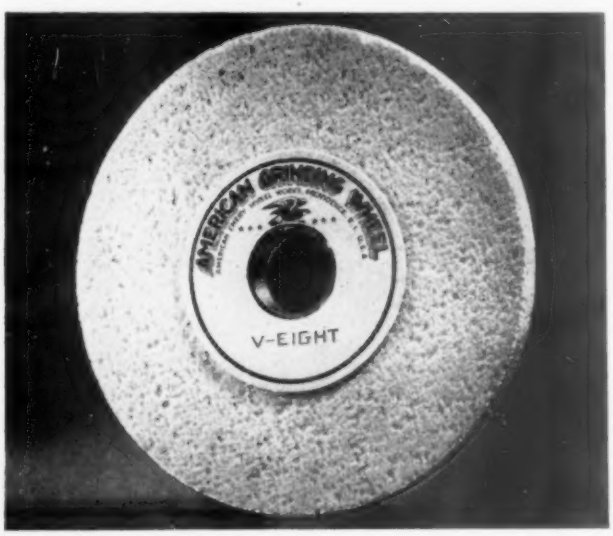
Designed to tap 87 holes in banks, top and exhaust pads of 8-cylinder engine blocks, a **MULTIPLE SPINDLE MACHINE** by *Baush Machine Tool Co.,* Springfield 7, Mass., taps 5916 holes per hour at about 85 per cent efficiency. Conventional Baush multiple-spindle units are incorporated in a base, with mounting units, of welded steel.



All units have individual lead-screw tapping heads and are arranged for motor drive. The blocks, to be machined, load on rails at front and are manually pushed into tapping position. Locating is by raising dowels into selected pan holes, and clamping is by means of air cylinders.

"V-Eight" Grinding Wheel

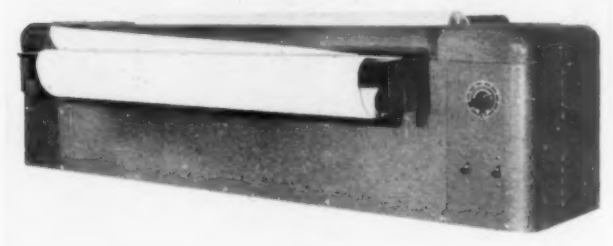
Said to be entirely different from any wheel now on the market, spectacular performance is claimed for a new "V-Eight" **GRINDING WHEEL,** just announced by *American Emery Wheel Works* of Providence, R. I. While the new wheel is similar, in structure, to the porous wheels which have been widely used in recent years, it holds its corners even under extremely heavy cuts and performs efficiently in dish and cup shapes. Its structure gives maximum air cooling for dry grinding and the open cells carry extra coolant when wet grinding. More metal is removed in less time and the wheel face is maintained with less dressing.



Indicative of good results on production work, and in the tool room, a .012" cut on hard steel, Rockwell No. 60 C, without loss of corner; 0.30" cut on soft tool steel; .040" cut on oil-hardened tool steel—and many other heavy cuts on difficult materials may be cited as examples of performances. The "V-Eight" wheel held its corners on these jobs and was the only wheel which would satisfactorily grind Hi-chrome die steel.

Improved Continuous Printers

Improved "B-2" and "B-3" table-type **CONTINUOUS PRINTERS** are announced by *Peck & Harvey,* 5736 N. Western Ave., Chicago 45, manufacturers of blue printing and photographic equipment. These new "streamlined" printers offer several postwar improvements that make possible faster exposure, finer reproductions and greater operating efficiency.



They expose direct process black and white prints, blue prints and ammonia-type prints from tracings, charts, drawings, letters and other originals, with sharp, true-to-scale prints up to 44" wide in a continuous operation, in any lengths, at speeds from 6" to 42" per minute. Full particulars in P & H Bulletin.

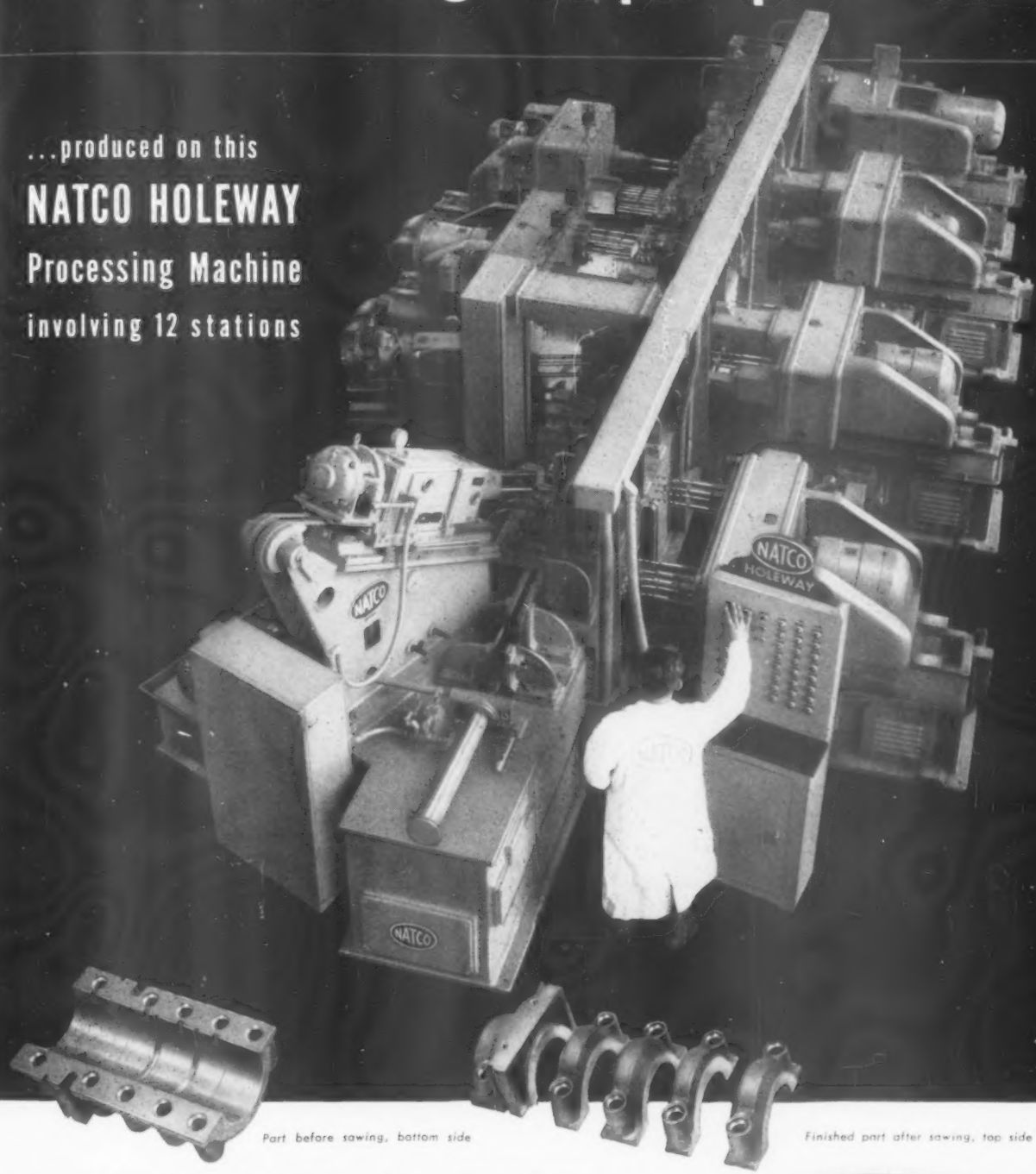
475 Bearing Caps per Hour

...produced on this

NATCO HOLEWAY

Processing Machine

involving 12 stations



Part before sawing, bottom side

Finished part after sawing, top side

One man on this NATCO HOLEWAY Processing Machine produces 95 of these bearing cap sets (475 individual bearing caps) per hour

• In keeping with the trend to automatic handling — less operator fatigue and more production per man — NATCO provides this processing type machine arranged to complete the following operations between loading position # 1 and unloading position #12: drills 20 holes; mill chamfers both sides of center bearing; drills 2 angular holes; combination drills and countersinks 2 holes; chamfer 10 holes; taps two holes; countersinks 10 holes; spotfaces 10 holes; mills 5 bearing liner lock notches; saws finished bearing casting into five component parts as shown above—and unloads automatically.

NATCO

Write today for NATCO Machine Circular 145-T

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, INDIANA, U.S.A. • *Branch Offices:* **1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City**

North East West South in Industry

Staples Tool Co., Cincinnati, manufacturers of Precision Carboloy Tipped Circular Cutting Tools, announces location of their new Detroit office at 2970 W. Grand Boulevard. **JOSEPH H. MILLER**, formerly Detroit sales engineer for National Automatic Tool Co., will be manager of the Detroit office for Staples.

WILLIAM F. McGRAW & CO., distributor of specialized industrial supplies, have recently occupied their new building at 575 E. Milwaukee Street, Detroit.

TED CAMPBELL has been named Chief Die Eng'r, **Pioneer Eng'g & Mfg Co.**, Detroit, according to announcement by **A. M. Sargent**, President. Mr. Campbell—for 17 years with F. Joseph Lamb Company—has had considerable experience as shop sup't in the building of dies for refrigerators, radios, automobiles, and many other items. He will be in charge of die design for metal stampings, die castings and plastics for the Pioneer organization.

AUSTIN LOGAN FORD, 4501 Prospect Ave., Cleveland, are now exclusive agents in Cleveland and northern Ohio for **Lovejoy Tool Co., Inc.**, Springfield, Vermont.

ROBERT L. SPRINGER (left) has rejoined the **Vanadium-Alloys Steel Company** as Engineer and Representative in the Chicago District. Also announced was the election of **Francis B. Nimick** as company Director to fill the vacancy created by the death of **T. H. Childs.** Mr. Nimick has been with Vanadium-Alloys since 1913.

KENNAMETAL, INC., Latrobe, Pa., announces that **Bennett Burgoon** will be in charge of their Central District Office, Detroit; with **E. C. Kelly** to be a newly appointed representative for that office. **George E. Smith** and **Wendell F. Grubbs** have been named representatives in Philadelphia. **Harry W. Bearfoot** is to be in charge of the Baltimore office; and **Thomas O'Connell** will supervise sales and service from offices in Asheville, N. Carolina. Additionally, **H & H Tool & Supply Co.**, Wichita, Kan., has been named agent for the selling and servicing of Kennametal Tools.

W. C. KEGG (right) has been named Personnel Director, **Progressive Welder Co.**, Detroit, according to **John D. Gordon**, Gen'l Manager. Gen'l Sales Mg'r, **L. M. Benkert**, also announces that **Walter Pestrak** has been made sales representative in southeastern Ohio and western Penn.; while **K. P. Swanson** will serve the eastern Conn., R. I., eastern Mass., Vt., N. H., and Maine territory as representative for Progressive.

As reported in the December issue, **Ernest C. Hawkins** was to have been placed in charge of the Chicago office for the John S. Barnes Corp'n. Due to change of plans, however, Mr. Hawkins has joined **Arnold J. Werner** in organizing the **ARNOLD J. WERNER COMPANY**, Detroit, to represent the Barnes Corp'n, as well as Struthers-Wells Corp'n, Dorr Sales & Eng'g Co., A. B. Farquhar Co., and the Avco Tool & Machine Div'n of the Aviation Corp'n of Toledo.

New factory soon to be built at **GENERAL ELECTRIC'S** Schenectady Wks. for the manufacture of steam turbines and electric generators. Turbines to be made in this 19-acre plant will range in size from 10,000 to 200,000 kw capacity. The structure will be provided with 200-ton cranes, and special machinery will range up to a 40-foot boring mill for machining castings weighing approximately 200 tons.

BRYANT CHUCKING GRINDER CO., Springfield, Vt., has appointed **W. M. Smith** as Gen'l Sales Mg'r, and **A. E. Stubbs**, Foreign Sales Manager. Also announced are Detroit offices at 19003 Mendota at 7 Mile Road West, under direction of **L. C. Gilchrist**; Chicago offices at 329 S. Wood St., with **Thomas Detherow** and **Walter Augustenovich** in charge; and Cleveland offices at 10022 Carnegie Ave., managed by **Robert F. Manley.** All sales through the Middle West territory are now being handled direct.

CARBOLOY (TRADEMARK) CEMENTED CARBIDE SHEET METAL DIES

Step up Die Life 10 TO 1 OVER STEEL DIES

In the manufacture of Metal Door Knobs for PACIFIC PLASTICS and MANUFACTURING COMPANY... maker of "Hollymade" Hardware

Successive steps in punching out metal door knobs by Pacific Plastics and Manufacturing Company

When Pacific Plastics and Manufacturing Company, fabricators of "Hollymade" Hardware, shifted from steel dies to Carboloy Cemented Carbide Dies for punching out metal door knob parts, here's what happened:

Die Life increased 10 times! (And at latest reports, these dies had not yet required grinding or polishing!)

That's money saved, time saved, production increased. And many other important advantages follow the change-over to Carboloy Cemented Carbide Sheet Metal Dies. For example—

Closer tolerances on drawn parts—fewer "rejects"—lower cost per piece—virtually mirror-smooth surface finish, with big reductions in buffing time—and sizeable increases in output-per-press.

• • •

If a letter of inquiry could lead to results like these in *your* plant, wouldn't you consider it time well spent? Why not write *today*—you'll receive by return mail our Booklet D-120, containing facts and figures that may start the ball rolling to big production improvements in *your* plant.

CARBOLOY COMPANY, INC.; 11124 E. 8 Mile Blvd., Detroit 32, Mich.

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NEWARK • PHILADELPHIA • PITTSBURGH • THOMASTON, CONN.

CARBOLOY (TRADEMARK) CEMENTED CARBIDE

SHEET METAL DRAWING AND BLANKING DIES

INCREASE OUTPUT
EXTEND DIE LIFE
HOLD CLOSE TOLERANCE
REDUCE "REJECTS"

THE LANDMATIC HEAD

LANDIS ALT COLLAPSIBLE TAP

THE LANDEX HEAD

The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
- Landmatic (for Turret Lathes and Screw Machines)
- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
- Standard Rotary Die Heads

PRECISION THREAD GRINDERS

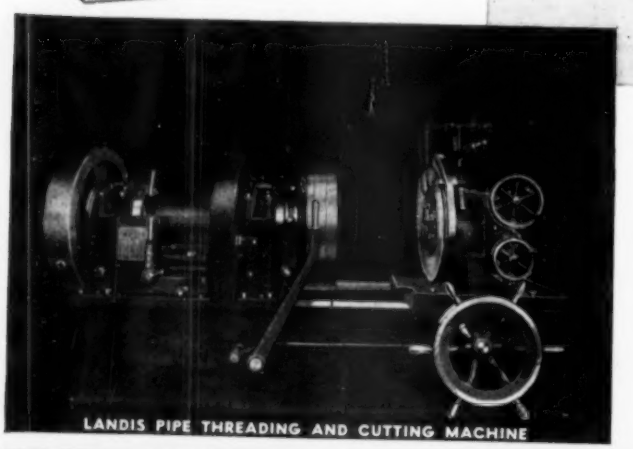
PIPE THREADING AND CUTTING MACHINES

ROLLER PIPE CUTTERS

CHASER GRINDERS

COLLAPSIBLE AND ADJUSTABLE TAPS

LANDIS CENTERLESS THREAD GRINDER



LANDIS PIPE THREADING AND CUTTING MACHINE

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

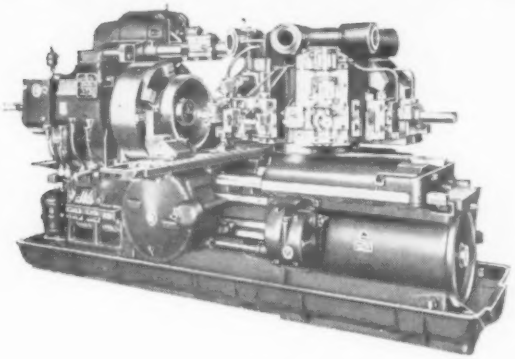
LANDMACO THREADING MACHINE

LANDIS [illegible] THREADING MACHINE

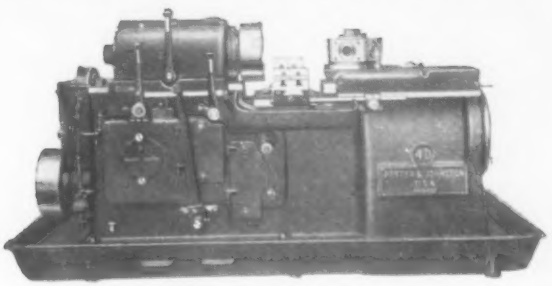
AUTOMATIC FORMING & THREADING MACHINE

P&J AUTOMATIC CHUCKING *and* TURNING MACHINES

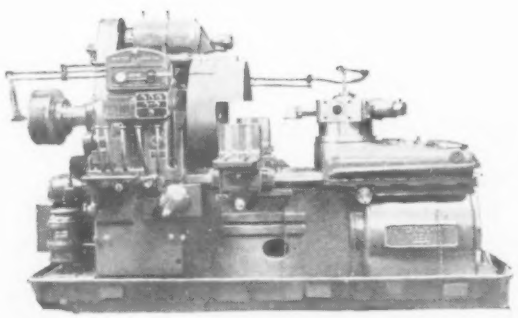
Leaders in their field for more than 40 years



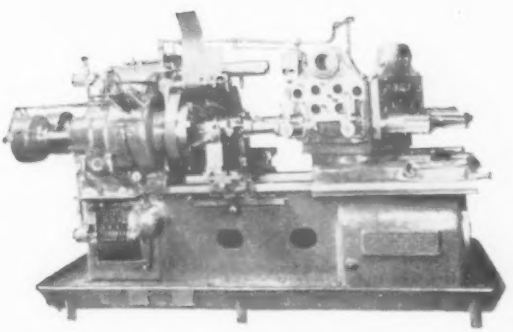
P&J 8DT and 8DXT Automatic



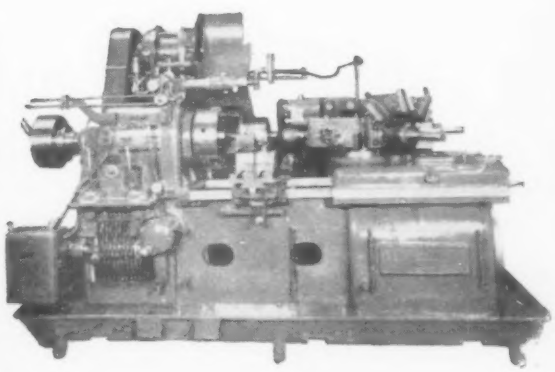
P&J 4D Automatic



P&J 6D REL and 6D REELX Automatic



P&J 5D Two Spindle Power-Flex Automatic



P&J 5D Power-Flex Automatic

BUY THOSE EXTRA VICTORY BONDS NOW!

The complete line of P&J Manufacturing Automatic Chucking and Turning Machines covers practically all requirements for size range of work. High accuracy, fast work and convenience in handling are assured whether parts produced are small or large. Every machine regardless of capacity, can be tooled and re-tooled to provide the utmost in flexibility for meeting specific machining requirements.

P&J engineers are available to help you with your production problems. Ask for descriptive literature covering P&J machines.

Authorized Agent, U. S. War Assets Corporation

POTTER & JOHNSTON MACHINE COMPANY

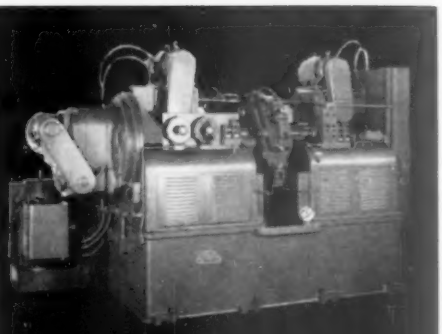
Pawtucket, R. I.

SNYDER builds practically every kind of special-purpose metal-cutting machine

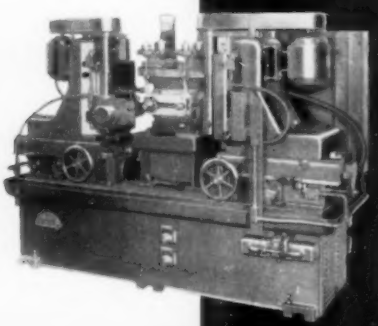
In the past 22 years we have designed and built hundreds of special-purpose machines for practically every metal-cutting operation. All of these machines have one common objective—to promote safety, to reduce handling and worker fatigue, to save time, materials, floor-space; to permit close process control through in-built, automatic accuracy; to expand markets through reduced cost. We invite your inquiries. *Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich.*

22 Years of Successful Cooperation with Leading American Industries

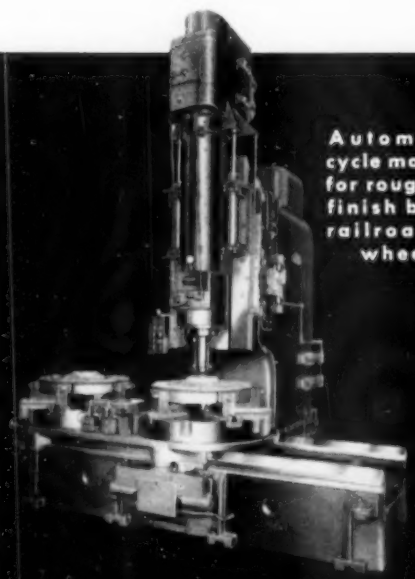
SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST



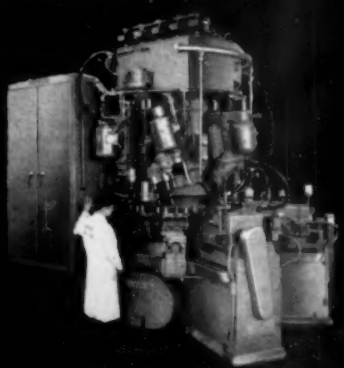
Special-Purpose machine for boring, facing and tapping valve bodies



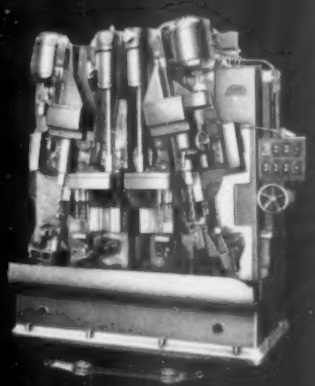
Double-End Connecting Rod Balancing Machine



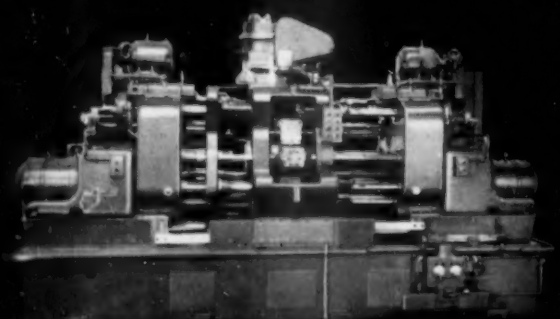
Automatic-cycle machine for rough and finish boring railroad car wheels



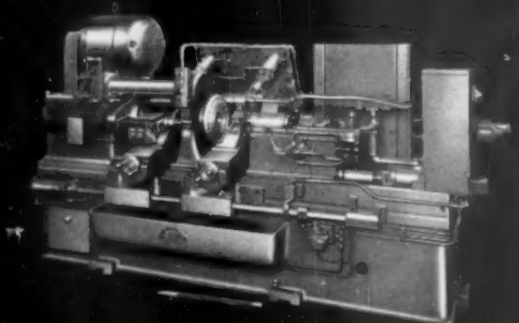
Special automatic performs sixteen operations on connecting rods



Automatic-cycle machine for drilling front truck axles



Double End Trunnion Type Machine for drilling, reaming, tapping



Center Drive, Double End Turning Machine

EFFICIENT SELF SERVICE

is a matter of Press Production

Modern merchandising owes much of its efficiency to a modern production method—*Press Production*. The Press is ideally suited to the production of panels for self-service refrigerators display counters, shelving—the many duplicated parts in the mechanism of a tabulating cash register.

In the press departments and Stamping Plants of America, Danly Die Sets and Die Makers' Supplies are recognized as a necessary part of good presswork, because Danly means *known dependable accuracy*.

DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue • Chicago 50, Illinois

DANLY
National Assembly

Call Danly

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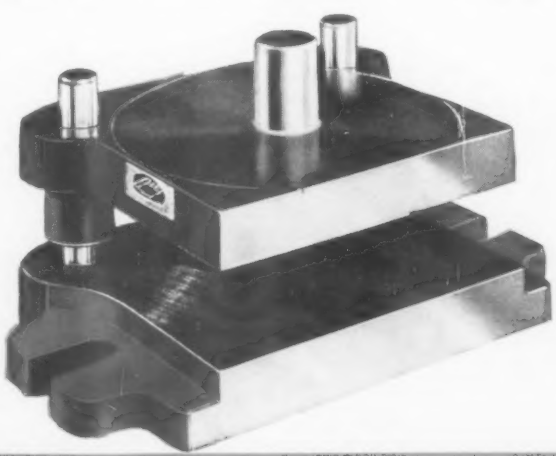
- **ROCHESTER 4**
  16 Commercial Street
- **PHILADELPHIA 44**
  18 W. Chelten Avenue
- **LONG ISLAND CITY 1**
  47-28 37th Street
- **DUCOMMUN METALS & SUPPLY CO.**
  4890 South Alameda, Los Angeles



DIE MAKERS' SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication

IN SPITE OF INCREASING COSTS...

YOU CAN SAVE PRODUCTIVE LABOR— INCREASE PROFITS WITH SPEEDY, ACCURATE

Farquhar

HYDRAULIC PRESSES

HERE'S HOW

FASTER PRODUCTION because of speedy advance and rapid return of the ram (provided by high and low pressure fluid circuits).

EFFICIENCY OF LABOR is improved because Farquhar Presses are so easy to operate.

FEWER REJECTS because Farquhar Presses are designed and machined for precision work.

MINIMUM REPRESSINGS because of sturdy frame construction and extra length guides.

300 Ton Metal Forming Press
With 75 Ton Cushion
Platen Area—72" x 48"
Available in all Sizes and Tonnages
Quick Deliveries

NEW

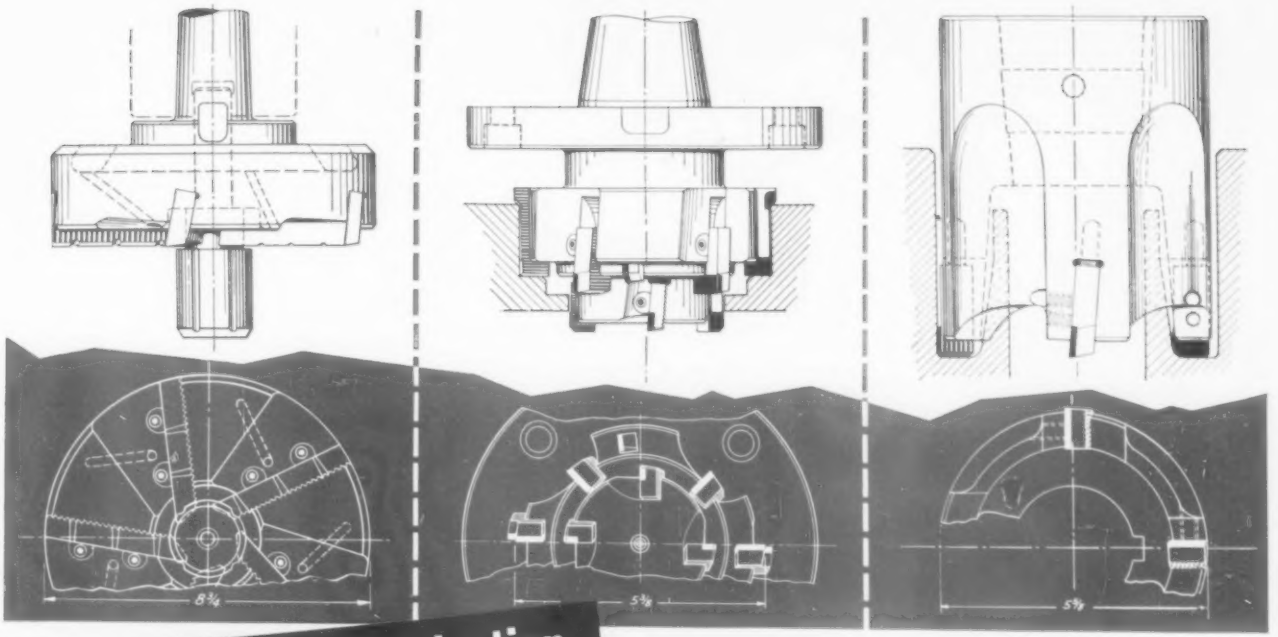
Let speedy, accurate Farquhar Hydraulic Presses earn higher profits for you.

Get full information by writing TODAY . . . ask for your free copy of our new 1947 catalog.

HYDRAULIC PRODUCTION PRESSES
MATERIAL HANDLING CONVEYORS • SPECIAL MACHINERY

Farquhar
HYDRAULIC PRESS DIVISION

A. B. FARQUHAR COMPANY
1519 Duke Street, York, Pennsylvania



Put Teeth into Production

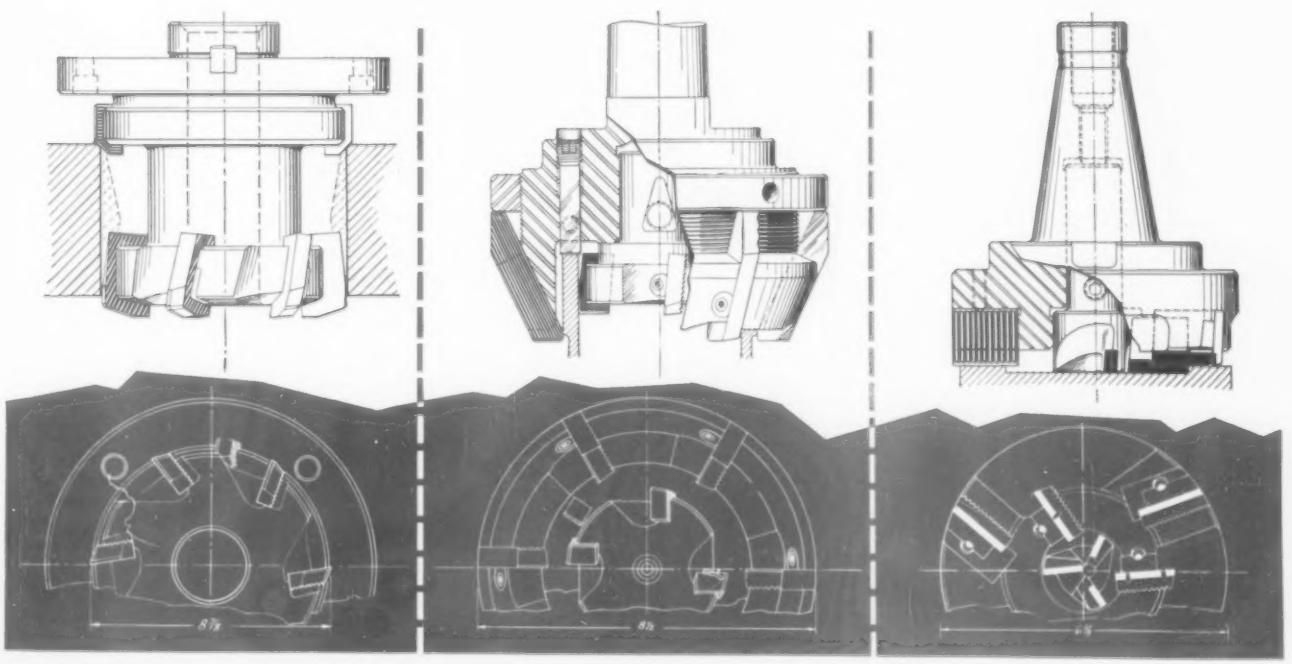
Gairing inserted blade cutter-heads combine simplicity, rigidity, and adaptability (multiple operations in one head) with ease and speed of adjustment.

Greater rigidity increases their ability to take heavier feeds. They provide solid, positive, independent support to the blades which may be of high speed steel, hard alloys, or tungsten carbide. Blades are designed with correct angle, positive or negative rake, and proper projection of the blades from the body. They are replaceable at a fraction of the cost of solid tools.

Gairing cutter-heads efficiently combine several cutter operations in one tool because the relation of each cutting edge is easily maintained and perfect concentricity between diameters is assured. *Also*—and this is important: Setup time on machining operations involving close tolerances is greatly reduced.

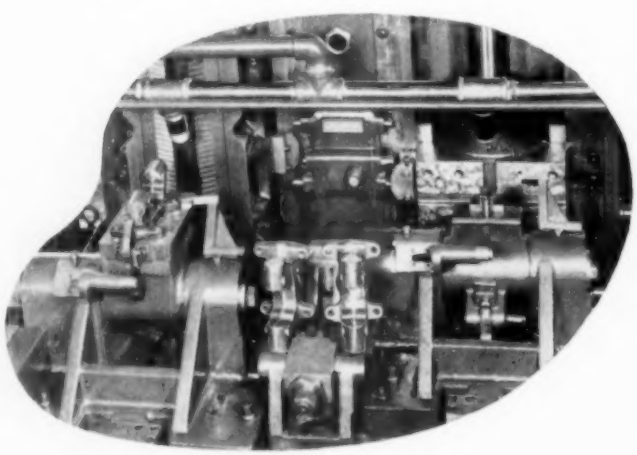
Our Engineering Department will gladly discuss any heavy cutting tool problem you have.

THE GAIRING TOOL COMPANY, DETROIT 32, MICHIGAN



INCREASE YOUR LABOR-PRODUCTIVITY by broaching ----- WITH Colonials

Typical and fairly average example of metal removal possible by broaching. Automotive steering knuckles—broached at rate of 360 pieces per hour on a Colonial Dual Ram machine . . . REMOVING 450 CU. IN. OF METAL AN HOUR!



Broaching offers one of the readiest answers to today's biggest manufacturing problem—how to increase the productivity of the individual worker to justify higher wages.

The reason of course is that broaching is the fastest method of metal removal known—and one of the most accurate. Moreover, though Colonial machines usually pay for themselves in short order, they do not become obsolete when models are changed.

With Colonial Broaching machines and broaches, and through Colonial's engineering service, you can obtain all the benefits of special purpose automatic machinery combined with the long life—for capital write-offs—of standardized machines.

Write us today for a study of how Colonials can increase your labor productivity. There is a Colonial field engineer near you.

colonial BROACH COMPANY
DETROIT 13, U.S.A.

Broaches — Broaching Machines - Broaching Equipment

WE PRODUCE THEM IN TOOL, DIE, STAINLESS SAE, OR NE STEELS—*Any Application!*

Write for New Booklet:

Smooth Hammered FORGINGS

Full information on the complete line of FCC Smooth Hammered Forgings... Rings, Hubs, Discs, Sleeves and other Forged Shapes; Intricate Shapes, Forgings for Hot Work Tools, etc.

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Write for it Today

ADDRESS DEPT. TE-49

BROAD experience before and during the war in forging tool and die blanks for almost every conceivable hot-work application has fitted our Forging and Casting Division to deal expertly with any problems that may arise in this exacting field.

Regardless of the kind of work to be done or material to be worked we are equipped to furnish you a correctly made forging of hot-work steel that will give you the utmost in effective performance.

Any Allegheny Ludlum field representative can give you further particulars; or write for the booklet today. (See description at left.)

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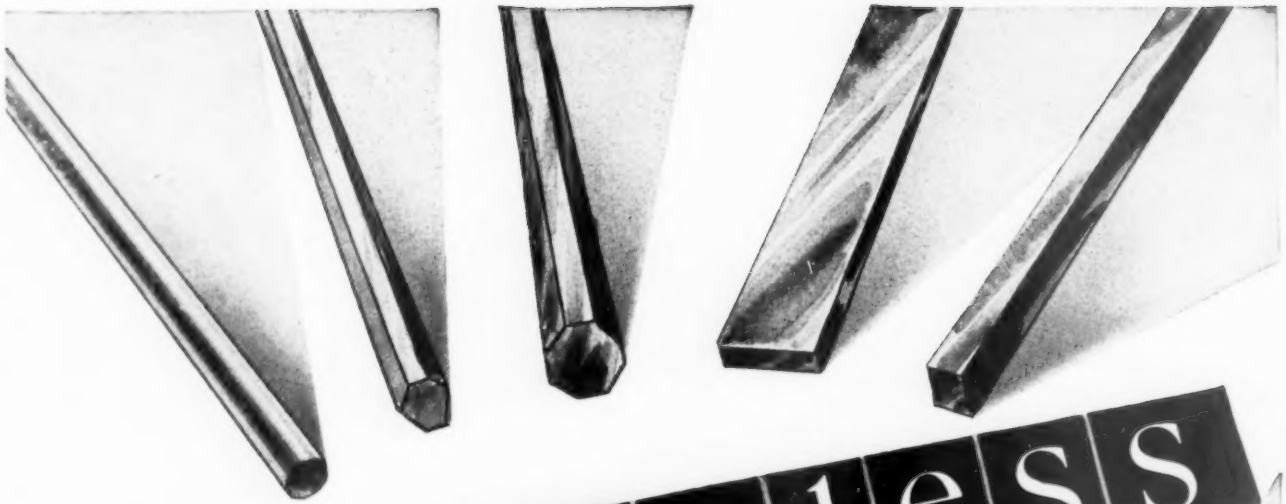
ALLEGHENY LUDLUM
STEEL CORPORATION
Forging and Casting Division
DETROIT 20, MICHIGAN

W & D 565



stainless STEEL

ONLY 10c PER POUND

FOR TOP QUALITY BARS AND PLATES IN PRODUCTION-RUN QUANTITIES

Think of it! Here's the steel you need *now*—priced far below mill prices. Warehouses must be cleared quickly for other surplus. Hence this amazing bargain today.

At this price you can afford to stockpile even against next year's requirements—for these savings will pay storage and interest charges over a long, long time.

Order today from any War Assets Regional Office. But for quickest delivery and less risk of disappointment, order from these offices which have the stock on hand:

types available:

302, 303, 304, 347, 416, 420, 431, 440. Rounds, hexagons, octagons, flats, squares.

Also fair quantities of stainless steel tubing at about 50% discount from net mill prices f.o.b. location.

★ ★ ★

Orders not accepted for less than 5000 lbs., except where the inventory of any individual item is less.

The material offered is subject to withdrawal prior to shipment.

RESERVE FOR PRIORITY CLAIMANTS—This material is offered for sale in the following sequence as provided by law: (1) Certified Veterans of World War II; (2) Subsequent priority claimants in proper sequence; (3) Non-priority purchasers. Federal agencies have had opportunity to fulfill their needs. Veterans of World War II should apply to their nearest War Assets Administration certifying office for certification. The case number shown on the certification, the date of the certificate, and the location of the certifying office must be stated in a veteran's offer to purchase.

Stainless Steel is available for export. Any question on export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

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Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago Cincinnati • Cleveland • Dallas Denver • Detroit • Fort Douglas, Utah Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock Los Angeles • Louisville • Minneapolis Nashville • New Orleans • New York Omaha • Philadelphia • Portland, Ore. Richmond • St. Louis • San Antonio San Francisco • Seattle • Spokane Tulsa

157-10

ADD THIS PLANT TO YOURS IN 1947

THE HEALD MACHINE COMPANY is more than a machine tool manufacturer; it is a service organization for assisting industry in its many problems of how best to improve quality and cut costs.

Check with our Field Engineers

Perhaps you have a bothersome manufacturing problem on your new product, or wish to increase production and still improve the quality of your present goods. If so, any one of the 45 field engineers at our branch offices will be glad to study it over with you.

We can also offer you the services of our 150 engineers at Worcester. These men can turn to records covering 40 years of experience on precision finishing jobs the world over, and can offer suggestions and sketches to meet your most critical requirement.

Or visit us at Worcester

Put our plant to work for you. Call our nearest branch office, or better still make a personal visit to Worcester, where you can see for yourself our facilities for serving you. THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision . . . less cost

Branch Offices at Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

INCREASE *Production*...
DECREASE UNNECESSARY HEADACHES BY ORDERING
CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES

The most efficient tools are brazed with carbide tips on hardened high-speed steel bodies, so that the total length of the flutes and pilots Rockwell C-62-63.

It has also been proven in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less spring back under heavy cuts for this same reason. Also, the flutes and pilots will not score or pick-up due to the hardness of the high-speed steel and long wear on the pilot.

If you have a cutting tool problem, DETROIT REAMER & TOOL COMPANY would appreciate an opportunity to work it out with you.

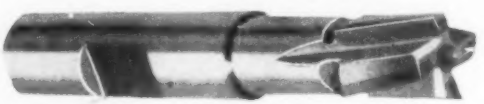
Write for QUOTATION

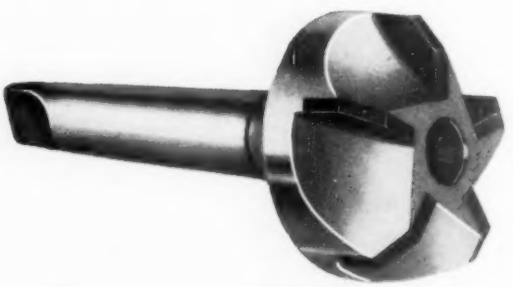
• MADE TO YOUR SPECIFICATIONS •

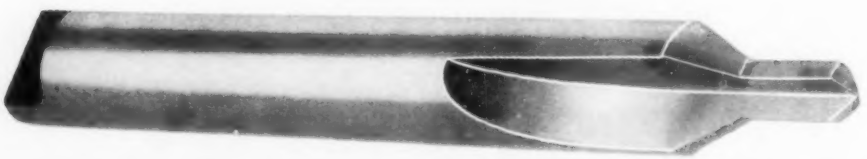
DETROIT REAMER & TOOL CO.

2830 E. Seven Mile Road — Detroit 12, Michigan

Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools







SUBLAND REAMERS
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LINE REAMERS
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CENTER DRILLS
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COUNTERBORES
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CORE DRILLS
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END MILLS
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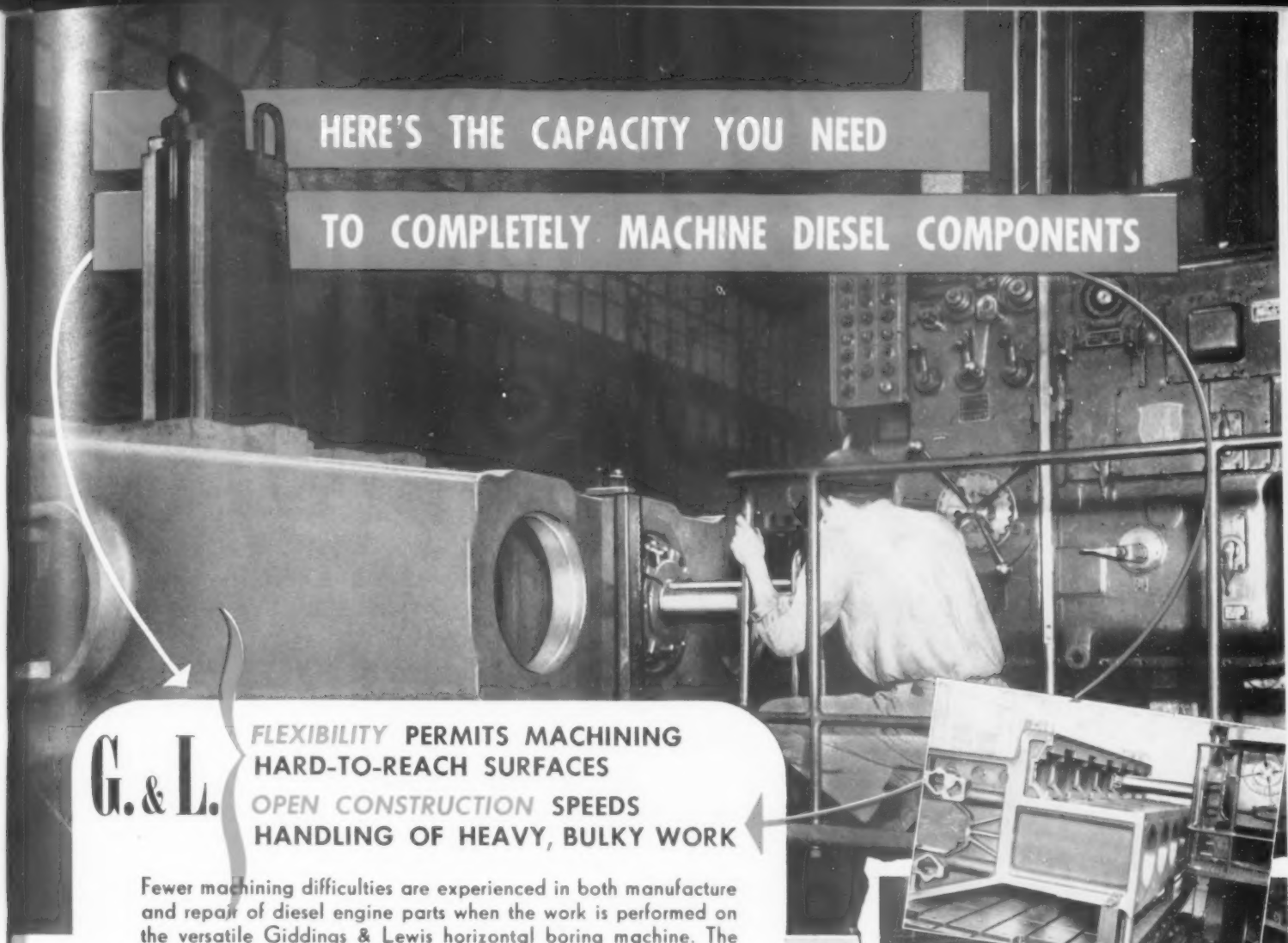
Special Tools
To Your Specifications

HERE'S THE CAPACITY YOU NEED TO COMPLETELY MACHINE DIESEL COMPONENTS



G. & L. *FLEXIBILITY* PERMITS MACHINING HARD-TO-REACH SURFACES

OPEN CONSTRUCTION SPEEDS HANDLING OF HEAVY, BULKY WORK

Fewer machining difficulties are experienced in both manufacture and repair of diesel engine parts when the work is performed on the versatile Giddings & Lewis horizontal boring machine. The diesel part may extend in any plane for there are no interfering columns or supports to limit work size. Once the part is correctly set up, a wide variety of milling, drilling, boring, reaming, facing, backfacing, and similar operations are easily performed.

Flexibility of the Giddings & Lewis machine makes it a simple matter to raise, lower or extend the spindle to reach surfaces which would be inaccessible on other equipment.

REPAIRING AND REBUILDING DIESELS

An example of one of the most common repairs made on a diesel is reboring the main bearings. In the manufacture of an engine, main bearings are bored using some type of supporting fixture.

When repairing and reboring one, two, three or even more damaged bearings, a fixture is not required. The good bearing closest the one to be rebored is bushed to support the bar. After the operation is completed, the new bore is then bushed and it in turn supports the bar.

Factory repair and rebuilding operations on different diesels may be simulated in any shop equipped with a Giddings & Lewis horizontal boring machine. G. & L. engineers will be glad to recommend the machine best suited to your need.

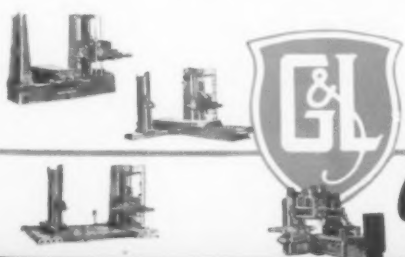
(Above) Boring the cylinder liner seats of a large diesel block.

(Center) Hard-to-reach surfaces such as this camshaft bearing saddle are easily milled by extending the machine spindle.

(Below) Boring seven main bearings simultaneously. Internal bar support fixture is used as shown in this manufacturing operation.

Helpful Production Facts FREE

Descriptive of interesting field cases showing profitable uses for Giddings & Lewis machines. Write for Production Data Folder TE-17.



Giddings & Lewis MACHINE TOOL CO.

132 DOTY ST. • FOND DU LAC, WIS.

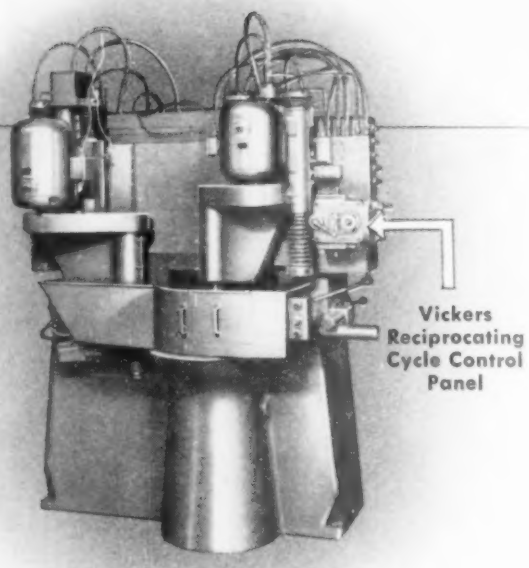
SPRINGFIELD MACHINE TOOL COMPANY

Uses

VICKERS
HYDRAULIC CONTROLS

to achieve

- INCREASED PRODUCTION
- BETTER WORK FINISH
- SIMPLICITY OF INSTALLATION
- VERSATILITY OF OPERATION
- PROTECTION OF MACHINE, WORK AND OPERATOR



Springfield Special Purpose Grinder

The manufacturer has utilized Vickers Hydraulic Controls on this special purpose grinder to provide an important increase in production, better work finish, simpler operation, and protection for the operator, machine and work.

The machine grinds the backface and bore of the ring gear in one setup. Each grinding wheel is reciprocated hydraulically in proper sequence. All phases of machine cycle operation are interlocked hydraulically to prevent damage to work and machine.

Vickers Reciprocating Cycle Control Panel provides smooth reciprocation of grinding wheel, thus providing better finish. Stroke lengths are adjustable and maintained accurately thus eliminating unnecessary and time-consuming overtravel for a specific setup. Adjustable speed hydraulic drive of work spindle makes possible the best combination of speeds for better finish.

Other Vickers Gasket Mounted Valves (in panel type assembly shown below) permit low cost installation and greater accessibility for adjustment and maintenance. They centralize hydraulic equipment for space saving and improved appearance . . . piping is simplified.

A Vickers Application Engineer will be glad to discuss with you how hydraulic controls can be used to advantage on your products. Get in touch with nearest office listed below.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.

VICKERS
Incorporated
1416 OAKMAN BLVD.
DETROIT 32, MICHIGAN

Application Engineering Offices:
ATLANTA • CHICAGO
CINCINNATI • CLEVELAND
DETROIT • LOS ANGELES
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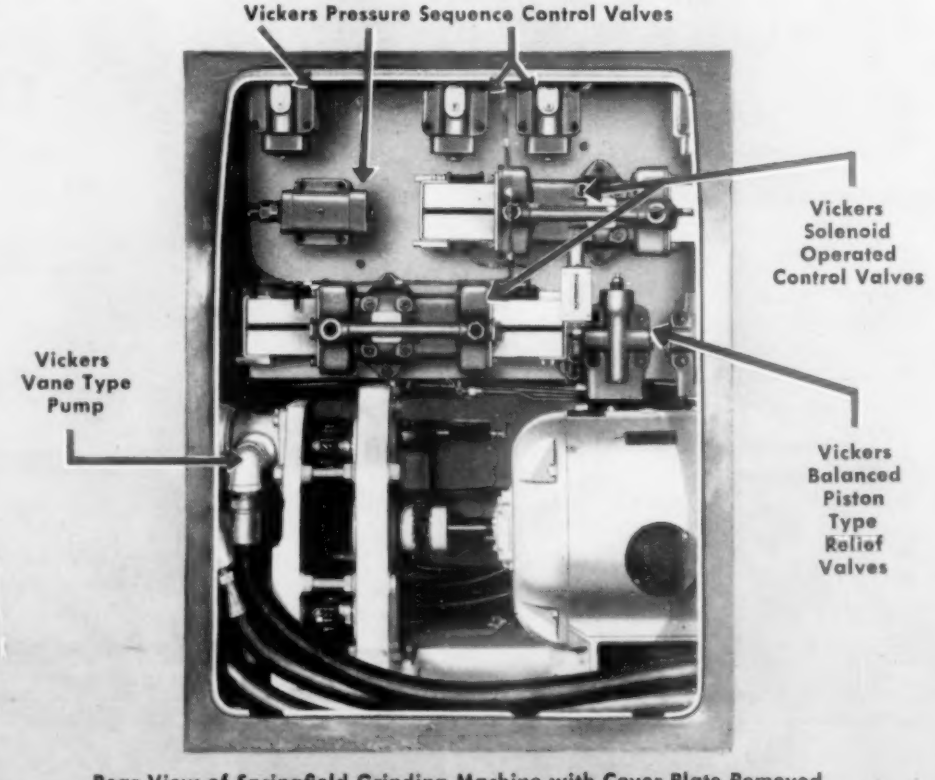
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Rear View of Springfield Grinding Machine with Cover Plate Removed

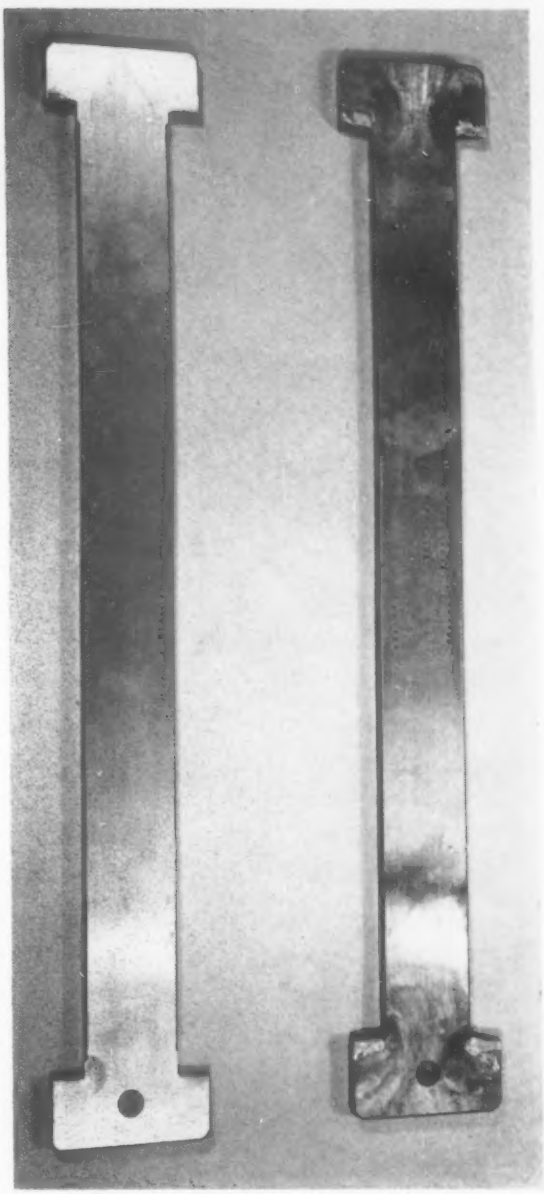
Make 'Em Yourself and face 'em with COLMONOY

They will outwear Steel Gauges 25 to 1

You can't beat Colmonoy No. 6 for gauging surfaces. It is a cinch to apply it on snap gauges like those shown at the right, by acetylene welding.

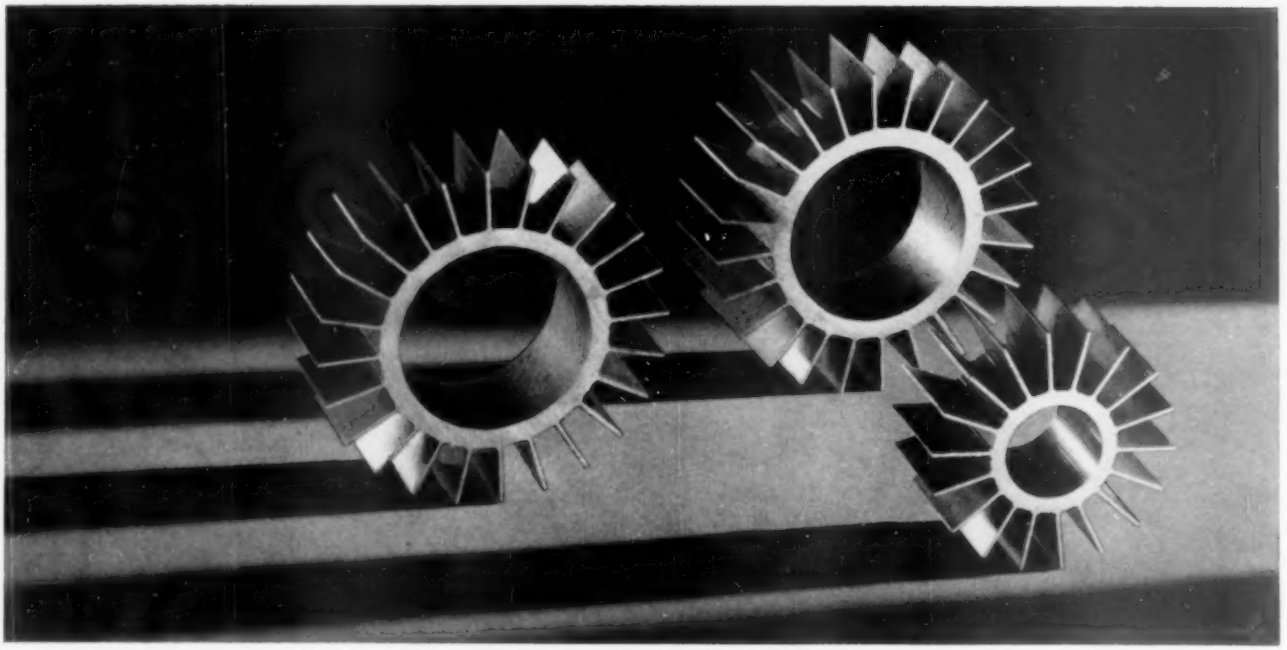
For round plug or intricately shaped gauges use the new Colmonoy Sprayweld Process to apply powdered Colmonoy No. 6.

The life of your Colmonoy faced gauges is 25 times that of hardened steel—the cost is usually less.



WRITE
for full information on Colmonoy hard-facing alloys.

WALL COLMONOY CORPORATION
7TH FLOOR FISHER BLDG., DETROIT 2, MICH.

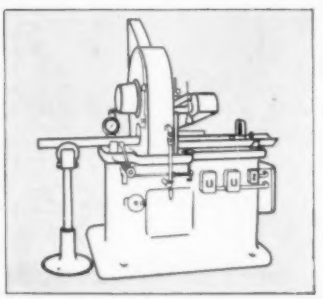


CUTS HEAT EXCHANGER TUBES FAST WITHOUT BENDING OR DISTORTION

Campbell Abrasive Cutter solves problem of cutting finned heat exchanger tubes. Hydraulically-controlled machine with Campbell-designed fixture permits fast, light-pressure cutting without bending or distortion of thin metal fins. Reduces rejects. Makes speedy production job of otherwise almost impossible operation.

BRIDGEPORT, CONN.—The No. 401 CAMPBELL Cutamatic cuts these 2 1/16" O.D. brass finned tubes in 12 seconds. Steel tubes of similar design are cut in 15 seconds. Cuts are clean and smooth. No finishing is necessary. Texture and shape of metal are not changed. Operating costs are low. Practically no rejects.

CAMPBELL makes a complete range of abrasive cutting machines. There are hand-operated, semi-automatic and full-automatic



models for regular production work. Plastics, ceramics and glass, annealed or unannealed and non-ferrous metals in solids, tubes, angles, channels, or odd shapes up to 10" O.D. can be cut.

New applications of CAMPBELL Abrasive Cutting Machines are developed to replace other methods of production machining. If you have a special problem which might possibly involve abrasive cutting, why not do this? Write and tell us (1) the range of sizes, (2) kind of material, (3) length of cutoff pieces, (4) length of stock before cutting, (5) tolerance for length of cut pieces, and (6) hourly production requirement. CAMPBELL engineers will recommend production procedure and work up cost sheets for you.

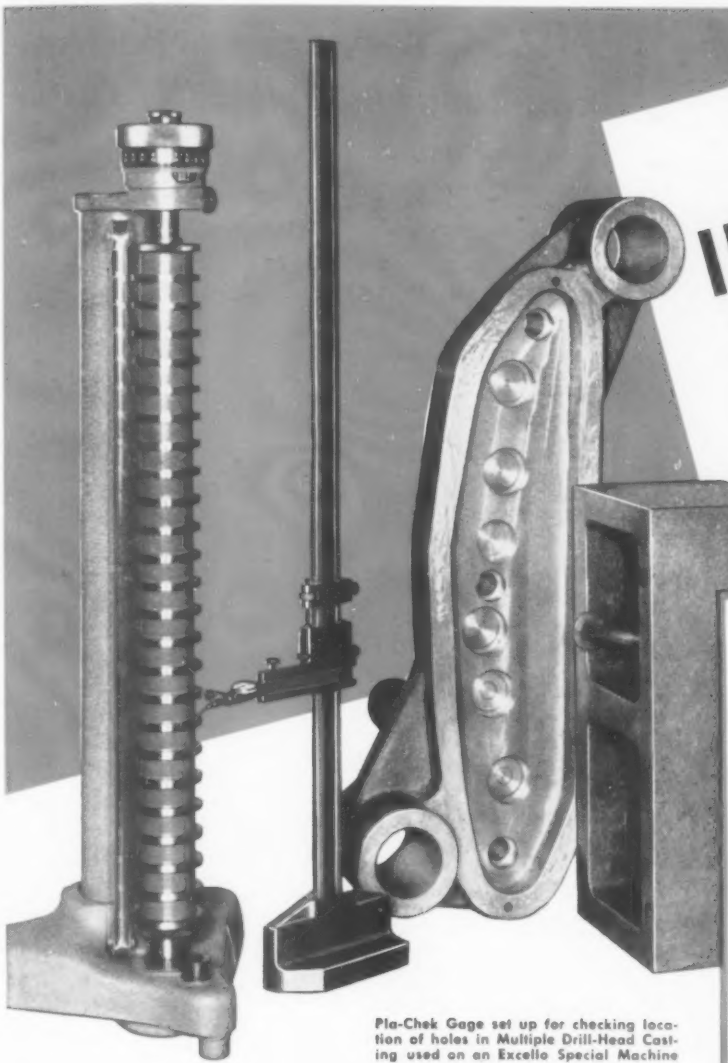
ACCO

TRADE MARK

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

ANDREW C. CAMPBELL DIVISION
AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

FAST INSPECTION To Split "Tenth" Accuracy!



Pla-Chek Gage set up for checking location of holes in Multiple Drill-Head Casting used on an Excello Special Machine

Supplies any Dimension to .0001" Accuracy in 24" Range

Cadillac Pla-Chek provides height gage or micrometer settings five to twenty times as fast as any other gaging method of comparable accuracy. In fifteen seconds or less, Pla-Chek establishes *any* dimension within its twenty-four inch range to limits of less than one ten-thousandth inch. No auxiliary gage blocks are necessary—Pla-Chek is totally self-contained and extremely simple in operation. Dimensions can be taken either from the surface plate or from a base line on the work. Measuring bar is not touched by hand and is unaffected by body heat. Widely adopted for surface plate layout, surface plate inspection and master reference. Order Pla-Chek today. Write for literature.

Cadillac PLA-CHEK

SPEEDS AND SIMPLIFIES SURFACE PLATE INSPECTION

MICROMETER THIMBLE

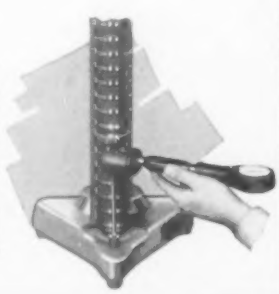
Micrometer thimble graduated to .0001" provides dimensions intermediate between 1" steps on measuring bar. Measuring bar can be adjusted to centerline of work to be inspected, enabling the user to take readings up or down relative to a center line or other reference line on the work.

MEASURING BAR

Measuring bar is made of deep-frozen strain-free alloy steel and all reference surfaces are ground and lapped to extremely accurate tolerances.

FOR MASTER REFERENCE

Inside micrometers, telescoping gages or internal cylinder gages can be checked between a lapped reference button in the base, and a Reverse Checking Plate clipped to the measuring bar.



Cadillac GAGE COMPANY

20316 HOOVER ROAD DETROIT 5, MICHIGAN

INDUSTRIAL FURNACES

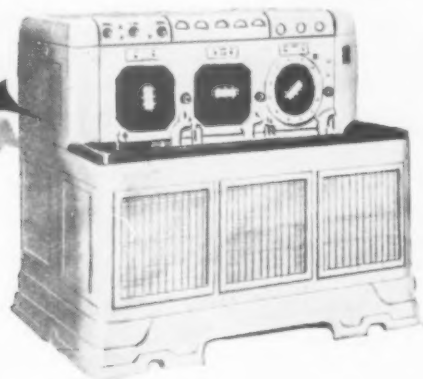
now is the right time to buy

because

WAA prices are low
Furnaces are for immediate sale
Large selection now from which to choose

The War Assets Administration offers many types of surplus electric, gas and oil industrial furnaces—furnaces which should be on industry's production lines today. The offering includes models of well-known manufacturers covering uses such as:

Metallurgical furnaces
Heat treating furnaces
Heating furnaces
Metal melting furnaces
Drying and baking ovens
High frequency induction furnaces



"TOCCO" INDUCTION HARDENER. Special Listing of WA B-47 Tocco units available at all Regional Offices.

To: WAR ASSETS ADMINISTRATION (Address nearest Regional Office)

We are interested in obtaining information on a furnace with the following specifications:

Use .....

Type .....

Size Working Space .....

Fuel .....Elec.....Gas.....Oil.....Max. Temp..... F....

Other Equipment .....

.....

Name .....

Firm .....

Address .....

City .....State.....

Although this material has previously been offered to priority claimants, 10% of the merchandise has been reserved to fulfill any further needs of priority claimants including VETERANS OF WORLD WAR II, who are invited to contact the Regional Office serving their area.

This equipment is available for export. Any question on export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta · Birmingham · Boston · Charlotte Chicago · Cincinnati · Cleveland Dallas · Denver · Detroit · Fort Douglas, Utah · Fort Worth Helena · Houston · Jacksonville Kansas City, Mo. · Little Rock Los Angeles · Louisville · Minneapolis · Nashville · New Orleans · New York · Omaha Philadelphia · Portland, Ore. Richmond · St. Louis · San Antonio · San Francisco Seattle · Spokane · Tulsa

838-1

TORQOMATIC

A UNIVERSALLY ADAPTABLE TORQUE-DRIVEN TOOL . . . BY *Jarvis*

The most advanced tapping attachment . . . in design . . . in trouble-free performance . . . in ease of operation. It is ultra sensitive . . . produces high quality threads . . . operates without pressure on the tap . . . produces more tapped holes per hour . . . saves taps. The JARVIS TORQOMATIC is the most efficient tapping attachment developed to date and is, therefore, the most economical.

Ask for the well-illustrated, fully descriptive folder on JARVIS TORQOMATICS. It shows you how to increase quality production at lower cost. WRITE TODAY, Dept. 222, Jarvis Power Tools, Middletown, Connecticut.

The CHARLES L. JARVIS Co.

MIDDLETOWN, CONNECTICUT

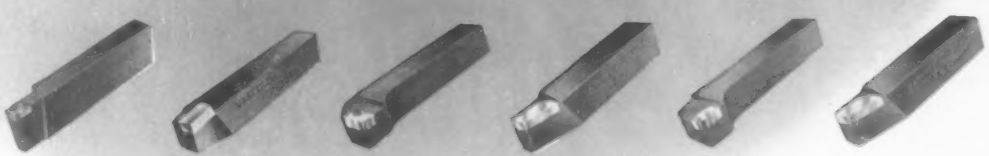
TAPPING ATTACHMENTS • FLEXIBLE SHAFTS AND MACHINES
GROUND ROTARY FILES • QUICK CHANGE CHUCKS AND COLLETS

Specify Carbide

VR CARBIDE

. . . and you specify the finest cemented carbide in industry. There is a V-R GRADE for every type of machining, each the most outstanding in the field. Regardless of your tool requirements, V-R can provide you with the proper tool and correct grade for maximum cutting performance.

REMEMBER TOO! . . . Vascoloy-Ramet's research facilities and field engineering service is available to help all manufacturers produce a better and less costly product.



XX Grade. For Steel. For heavy duty and shock applications at low and medium speeds.

X Grade. For Steel. Similar to grade XX more wear-resistant.

EH Grade. For Steel. Recommended for precision boring and light finishing cuts at high speeds where close tolerances are essential.

2A3 Grade. For cast iron, non-ferrous and non-metallic materials. For heavy work at medium speeds or interrupted cutting under shock conditions.

2A9 Grade. For cast iron, non-ferrous and non-metallic materials. The hardest and most abrasive-resistant grade of cemented carbide available.

AW Grade. For machining at heavy feeds and slow to medium speeds.

Ask your nearest Vascoloy-Ramet Field Service Engineer about "CUSTOMER STANDARDS." Tools made to your design quickly, in any grade or quantity at moderate prices.

Send for the NEW V-R 400 Tool and Blank Catalog that's brimming with vital cemented carbide tool and engineering information. Practical, up-to-the-minute data on modern carbide tools that's a reference MUST for tool engineers.

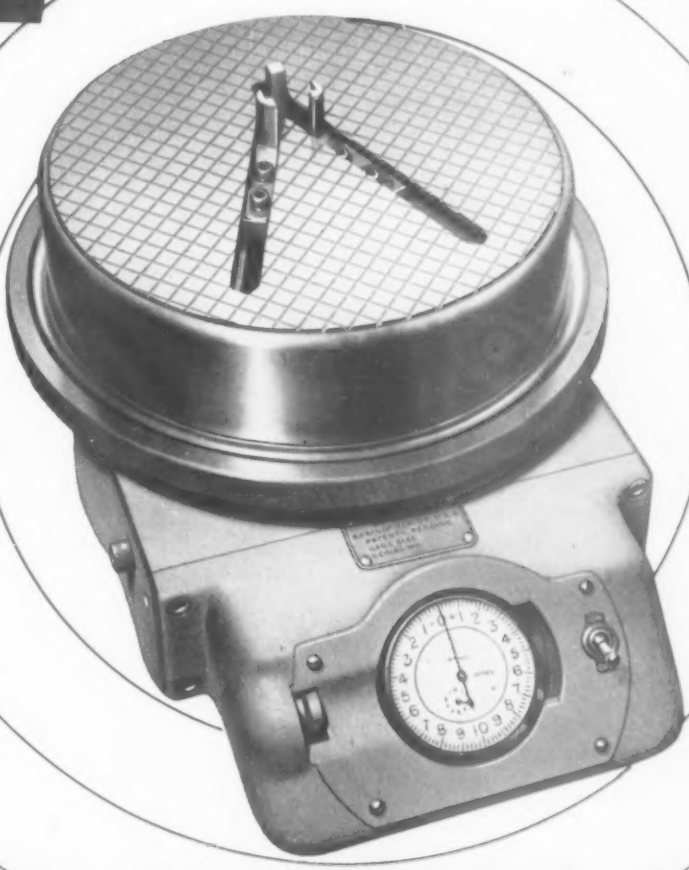
MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORP. NORTH CHICAGO ILLINOIS

An affiliate of Fansteel Metallurgical Corporation and Vanadium Alloys Steel Company

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

NEW



UNIVERSAL DIAMETER GAGE

Another Bryant Postwar Development

The New Bryant Universal Diameter Gage offers faster, simpler and highly accurate inspection of internal or external plain diameters from ⅜ inches to 4 inches — in fact, operation is so simple that after the gage has been set to a master ring, the operator has merely to place a part on the contacts and check accuracy to the nearest .00002 inch on the dial indicator.

Functional design and sound construction result in many labor saving features and assure long lived accuracy in the new gage. The serrated steel work table is adjustable to accommodate parts up to 1½ inches in depth. Diameter measurement is accomplished with three precision-ground, hardened-steel contact points. Two are movable and travel in unison to facilitate setting for different diameters. The third is a stationary sensitive contact which may be operated by a finger-tip control lever when necessary. The points are designed to contact the work at 90 degrees and automatically center it regardless of diameter. To further insure accurate readings, a vibrator actuates the movable mechanism and the dial indicator to disclose very minute variations in the part being checked — this eliminates "feel" for fit.

The new Bryant Universal Diameter Gage simplifies and speeds inspection of varying sized plain diameters — cuts quality control costs to a new low — it will pay you to write for complete details.

BRYANT

Also Bench Model Thread Gages, Adjustable Thread Gages, Squareness of Face Gages and Portable Thread Gages.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

San Bernardino, Calif.,
August 11, 1946.

The Cushman Chuck Co.,
Hartford,
Connecticut.

Gentlemen:

It occurred to me that you might be interested in one of your chucks which I have.

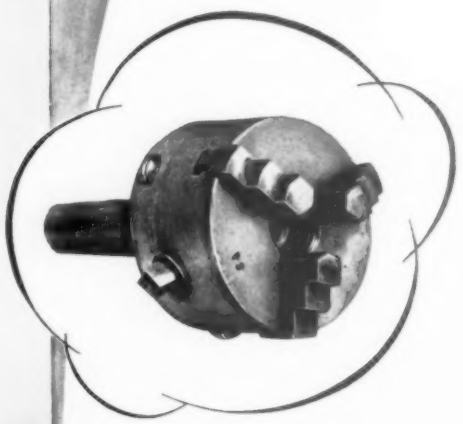
This chuck belonged to my grandfather and then to my father. My grandfather was past eighty when he died 37 years ago. My father had a gun store and repair shop about 70 years ago and used it there. It is still in perfect condition. It has the name CUSHMAN and No. 24. No doubt your records will show when it was made.

Do you know any of your chucks as old as this that are still in use?

I am a machinist employed by the Santa Fe R.R. and have this chuck on a little lathe in my workshop at home.

Yours truly,

F. W. Davis



UNRETOUCHED PHOTOGRAPH.
CHUCK MADE ABOUT 1876.

A Tribute to American Craftsmen

Naturally we were proud to hear of this Cushman Chuck which has faithfully served no less than three generations of machinists . . . and is still going strong. But what we like best about this letter is something written between the lines . . . a story of family pride in fine craftsmanship and fine tools which is a fortunate American heritage.

Consult CUSHMAN

THE CUSHMAN CHUCK CO.
Hartford 2, Conn.

Chucking Engineers Since 1862

CLE-FORGE SPECIAL PURPOSE DRILLS

TRADE MARK REG. U.S. PAT. OFF.

ARE *Engineered* FOR THE JOB

Proper selection of drills will enable you to produce better work *faster* and at lower cost. Special jobs call for Special Purpose Drills which have been developed to meet certain specific requirements. ◈ One example is found in the photo below showing a set-up of 148 Burner Drills. Their short flutes and sturdy construction make them ideally suited to overcome the difficulties of drilling castings of this kind. ◈ Send for your copy of new, illustrated booklet describing these and other Special Purpose Drills.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND 14

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

30 THOMAS ST., NEW YORK 7 • 9 NORTH JEFFERSON ST., CHICAGO 6 • 650 HOWARD ST., SAN FRANCISCO 5
2929 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 3, ENGLAND

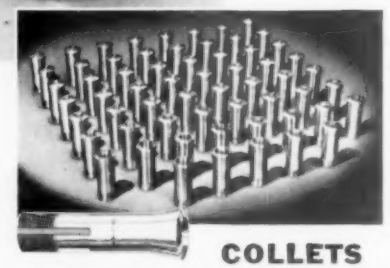
TO INSURE ACCURACY, USE—

SOUTH BEND *Precision* LATHES

South Bend Lathes help to increase plant efficiency and profits by raising precision standards both in the toolroom and in the production shop.

These lathes are designed and built to work to close tolerances and produce a smooth finish, for ease and speed of operation, and to give long, dependable service. Versatile, too, they are capable of performing a wide variety of operations on all types of machinable materials with a minimum of change-over and set-up time. Attachments are available which help to simplify and speed tooling for special classes of work, and in many instances eliminate the need for special fixtures.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, bed lengths to 12', and collet capacities to 1". Precision Turret Lathes are made with collet capacities to ½" and 1". Write today for Catalog 100-D which illustrates and describes the complete line of lathes and accessories.



COLLETS

Equip Your Lathes with Complete Sets

A complete set of collets is especially helpful for toolroom and maintenance work. Often the time saved in getting out a single rush job without having to wait for a specially ordered collet will more than compensate for the cost of a full set of collets.

South Bend Collets are made in four types, and are available in either steel or brass. Each collet is carefully inspected and tested before it is packed for shipment.

SOUTH BEND LATHE WORKS

531 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA

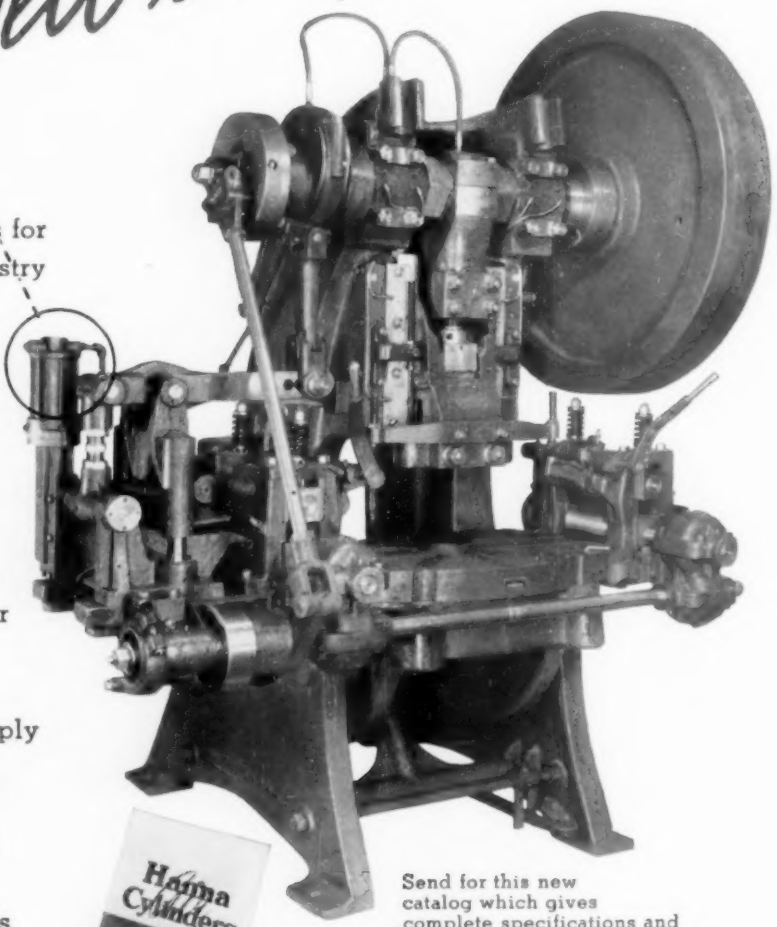
LATHE BUILDERS SINCE 1906

Another Job for Hanna Air Cylinders

"nerve center" for this Littell scrap cutter

JUST one of the 1001 uses for Hanna Air Cylinders in industry is the job this one performs on the Intermittent Scrap Cutter, illustrated at the right. This efficient cutter manufactured by the F. J. Littell Machine Company, depends on its Hanna Air Cylinder to act as a "nerve center" to actuate the cutter through a rack and pinion and an eccentric.

Hanna Air Cylinders supply safe, smooth, dependable power and control at low cost in countless industrial applications. Have you investigated the advantages they offer you?



Send for this new catalog which gives complete specifications and operating information on Hanna Air Cylinders. Just ask for Catalog No. 234; it's free.

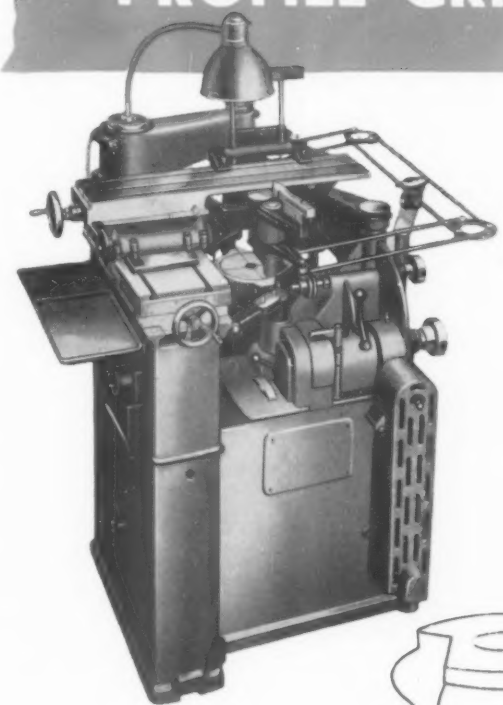
Hanna Engineering Works

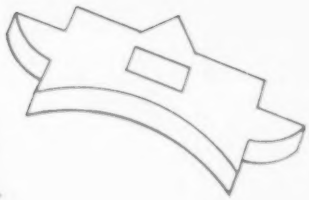
HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

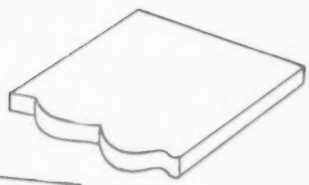
1765 Elston Avenue, Chicago 22, Illinois

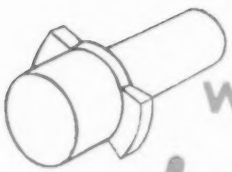
Fast

PROFILE GRINDING

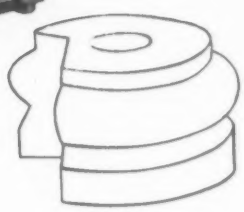


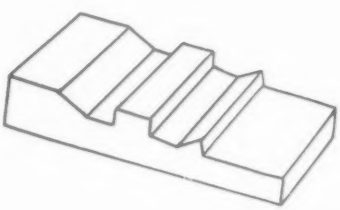






WITHIN LIMITS OF ± 0.0002"





THE STUDER PROFILE GRINDER

The Studer principle employs a tracer finger which follows the form of a template and transmits its movements to the grinding wheel through a pantograph. The wheel and stylus can be swiveled. Because the wheel is shaped beforehand proportionately to the exact shape of the tracer finger, an object can be ground over its entire length in one operation—with one wheel. Because a fixed template is used, errors due to incorrect manipulation are eliminated. A special template holder permits the grinding of circular forms of contours like cams over their entire circumference.

Now you can perform intricate profile grinding at practical high speeds and to exceptional degrees of accuracy! With the Studer Profile Grinding Machine Type PSM you can attain accuracy to within ± 0.002" in producing profile gages, straight or circular form tools, sectional dies, complete contours like cams, templates and similar parts of hardened steel. Profiles up to 5.9" in length can be ground from end to end in one continuous operation without moving work-piece or template. Circular work up to 4" in diameter can be ground, and flat pieces—several of which can be stacked for grinding at one time—can be handled up to 2" in thickness. Small sized profiles can be accurately produced without preliminary grinding to form, and clearance angles on parts such as form tools can be ground without removing the work from its original setting.

These are the highlight features of the Studer Profile Grinder. If you can use its exceptional accuracy, its speed and ease of operation, its amazing versatility, write for complete information.

We also represent in the United States these other makers of Swiss High Precision Equipment: Societe Genevoise d'Instruments de Physique (SIP), Andre Bechler, Mikron, Safag, Sallaz, Schaublein, Lienhard. Our engineers will be glad to work with you in specifying and using equipment for the highest precision machining.

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

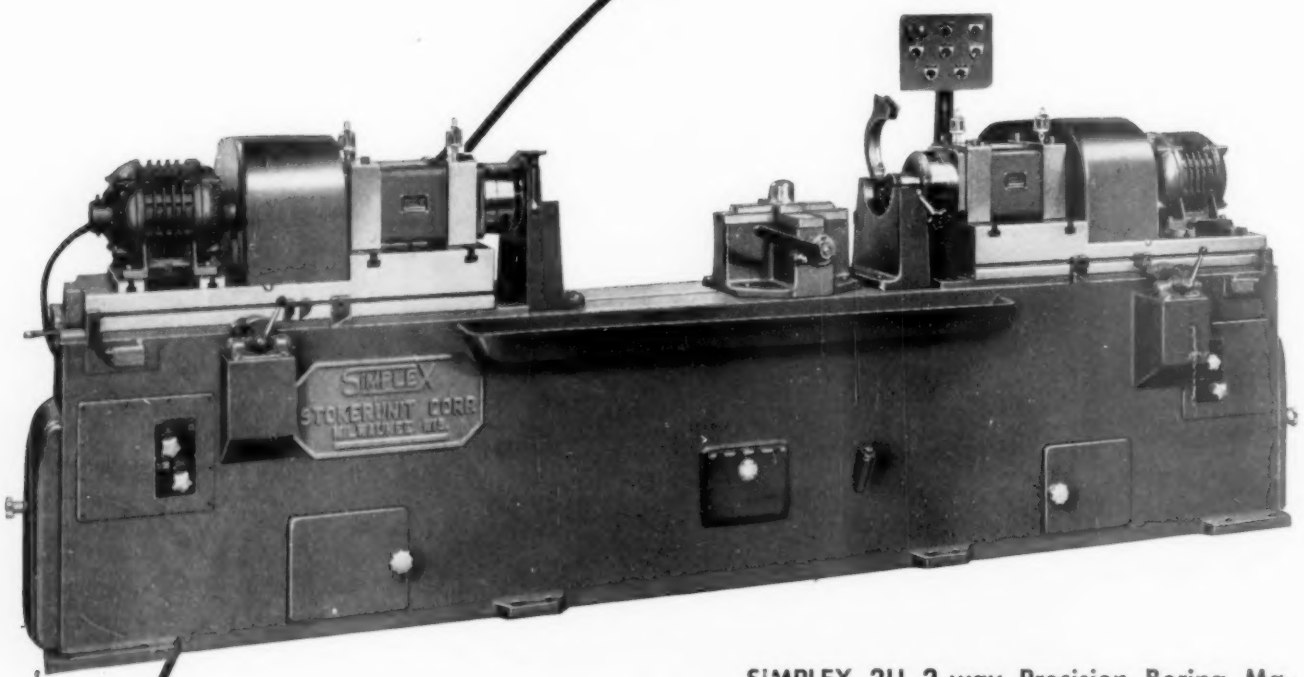
COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

SIMPLEX

A troublesome operation is the boring and turning of concentric cylindrical surfaces on bulky objects, rear axle housings, landing gear parts, etc. Equipment that will perform several operations at one setting of the work reduce these to their simplest form and provide low-cost production with high quality.



SIMPLEX 2U 2-way Precision Boring Machine with #4 spindles and extended bed center section mounting a fixture designed to handle varying lengths of work units, resulted in high production rates for moderate quantities, greater convenience for the operator, and a uniformly high standard of quality.

Precision Boring Machines

STOKERUNIT CORPORATION

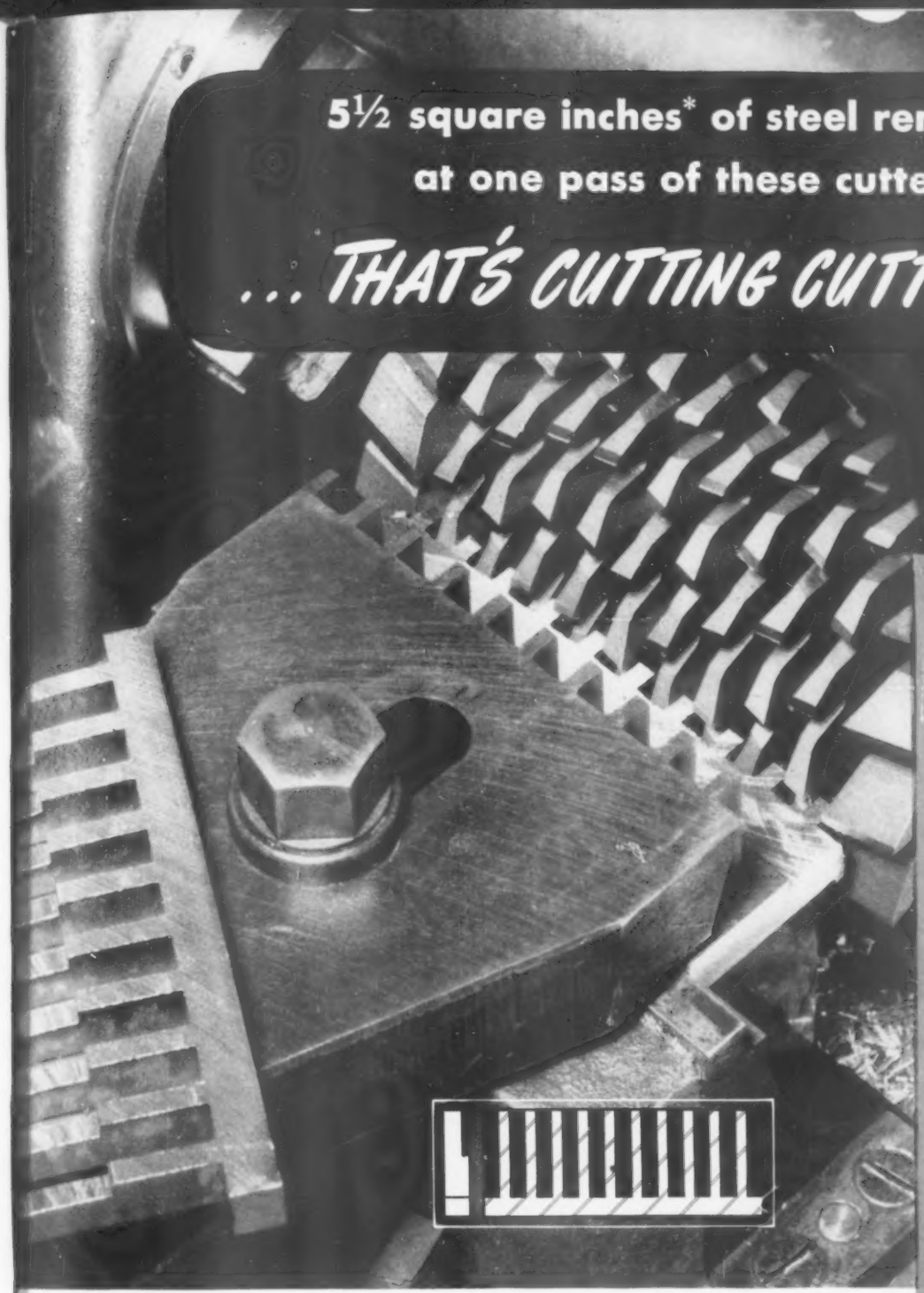
SIMPLEX Machine Tools Division

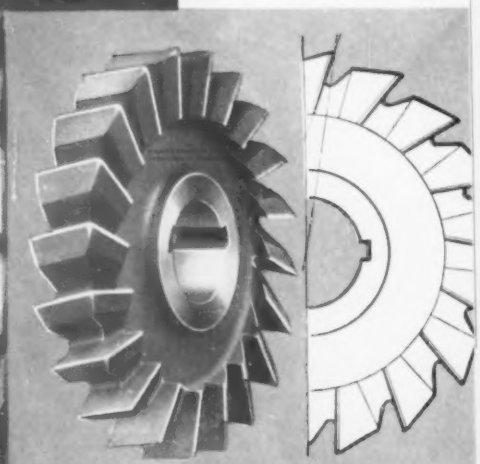
4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

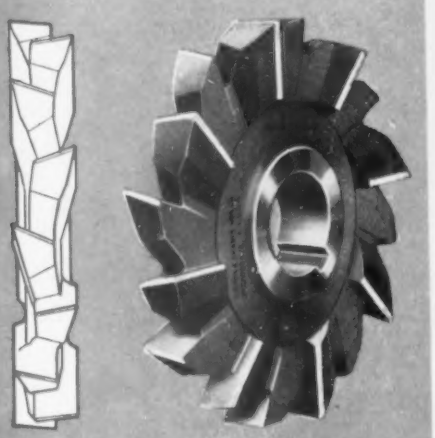
5½ square inches* of steel removed at one pass of these cutters

... THAT'S CUTTING CUTTER COST





Half Side Milling Cutters . . . used in straddle milling or cutting slots where complete bottom finish is not needed.



Staggered Tooth Side Milling Cutters . . . The alternate spiral angles of the teeth and the angle of undercut enable these cutters to remove large amounts of metal without destructive vibration or chatter. Deep cuts are made with good finish. Also used in making shallow cuts where depths must be varied.

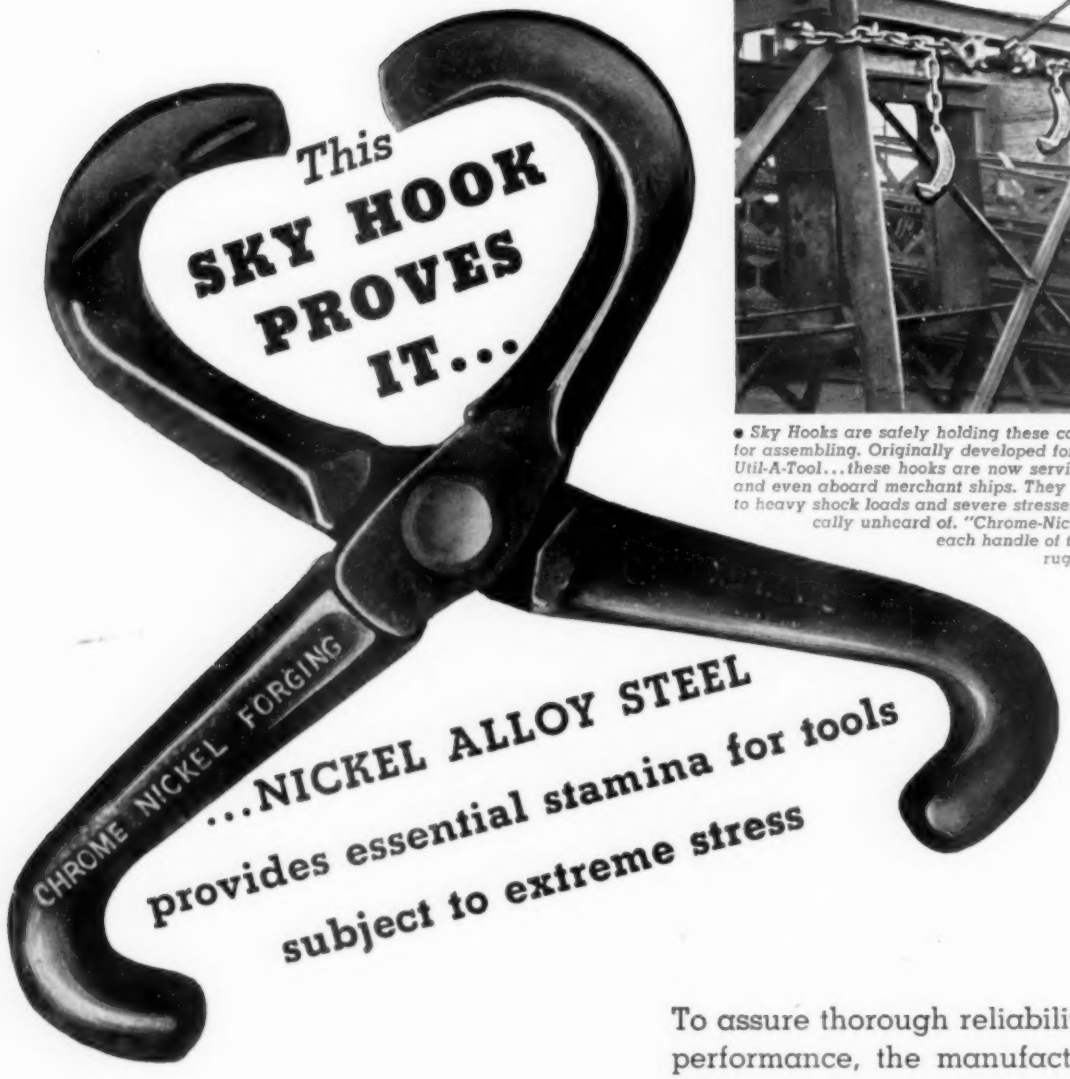
*Cross-section area of metal removed.

In the job above, nine slots 5/16″ wide and two end cuts 9/32″ wide . . . all 1-11/16″ deep . . . are being milled simultaneously by a gang of nine Staggered Tooth and two Half Side Milling Cutters. That's removing 5½ square inches (in cross-section area) of low carbon steel at a single pass. These Brown & Sharpe cutters are completing ten pieces per hour.

There's a *good* reason for preferring Brown & Sharpe milling cutters. They cut more metal per sharpening and cut it faster . . . all of which gives the lowest *real* cutter cost. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

B·S *We urge buying through the Distributor*

BROWN & SHARPE CUTTERS



• *Sky Hooks are safely holding these conveyor sections together for assembling. Originally developed for use with the "Simplex" Util-A-Tool...these hooks are now serving in shops, in the field, and even aboard merchant ships. They are frequently subjected to heavy shock loads and severe stresses, but breakage is practically unheard of. "Chrome-Nickel Forging" stamped on each handle of the Sky Hook makes such ruggedness understandable.*

The tong-like tool shown above is officially known as a "Sky Hook"...a unit widely used for attaching chains, quickly and securely, or suspending them from beams or pipes.

Designed and produced by Templeton, Kenly & Company of Chicago, Ill., the Sky Hook has abundantly demonstrated its outstanding strength and shock resistance as a working part of equipment used to straighten bent car chassis and axles...to pull in structural members, to help move or repair machinery and to perform countless other tough jobs.

To assure thorough reliability of Sky Hook performance, the manufacturer utilizes a Nickel alloy steel...Type 3145 Nickel-chromium steel...drop forged, and heat treated by quenching, and tempering to provide a yield point in tension of 150,000 pounds per square inch.

EMBLEM OF SERVICE
INCO
TRADE MARK
Nickel

Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

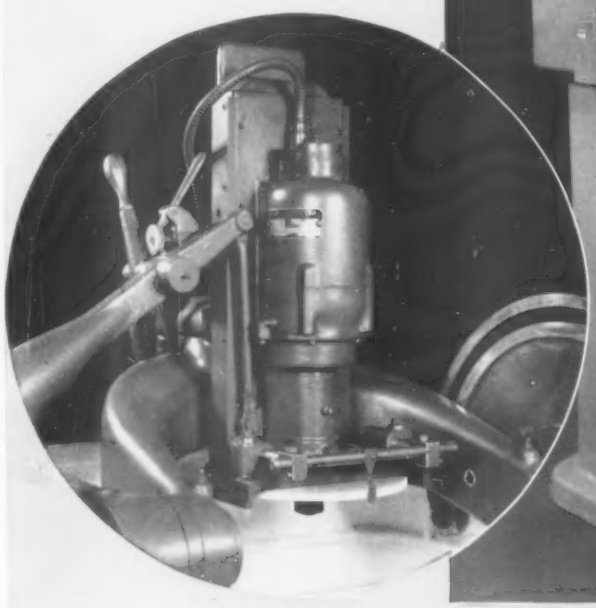
THE INGERSOLL *Cutter Grinder*

- **WITH NEW IMPROVED ROLLER BEARING HEAD SLIDE WAYS**

  Eliminating frequent adjustment — Reducing maintenance costs.

- **NEW REPLACEMENT HEAD AVAILABLE FOR OLD GRINDERS**

  Mounts in standard yoke. Write for quotation on new head.

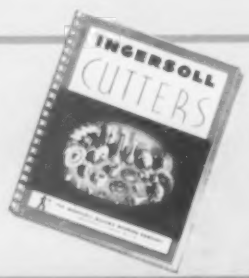


- The Ingersoll Grinder sharpens in a single setting of the cutter the face, periphery and corners of cutters from 4" to 30" in diameter. It will also grind solid shank, radius, staggered tooth, and angular inserted blade cutters.

For more details, write for Bulletin 54A describing its wide range of application.

- Ingersoll also builds a complete line of inserted blade milling and boring tools with carbide tipped, cast alloy, or high speed steel blades — face mills, end mills, slotting cutters, helical slabbing mills, cylinder boring and combination boring, facing and chamfering tools.

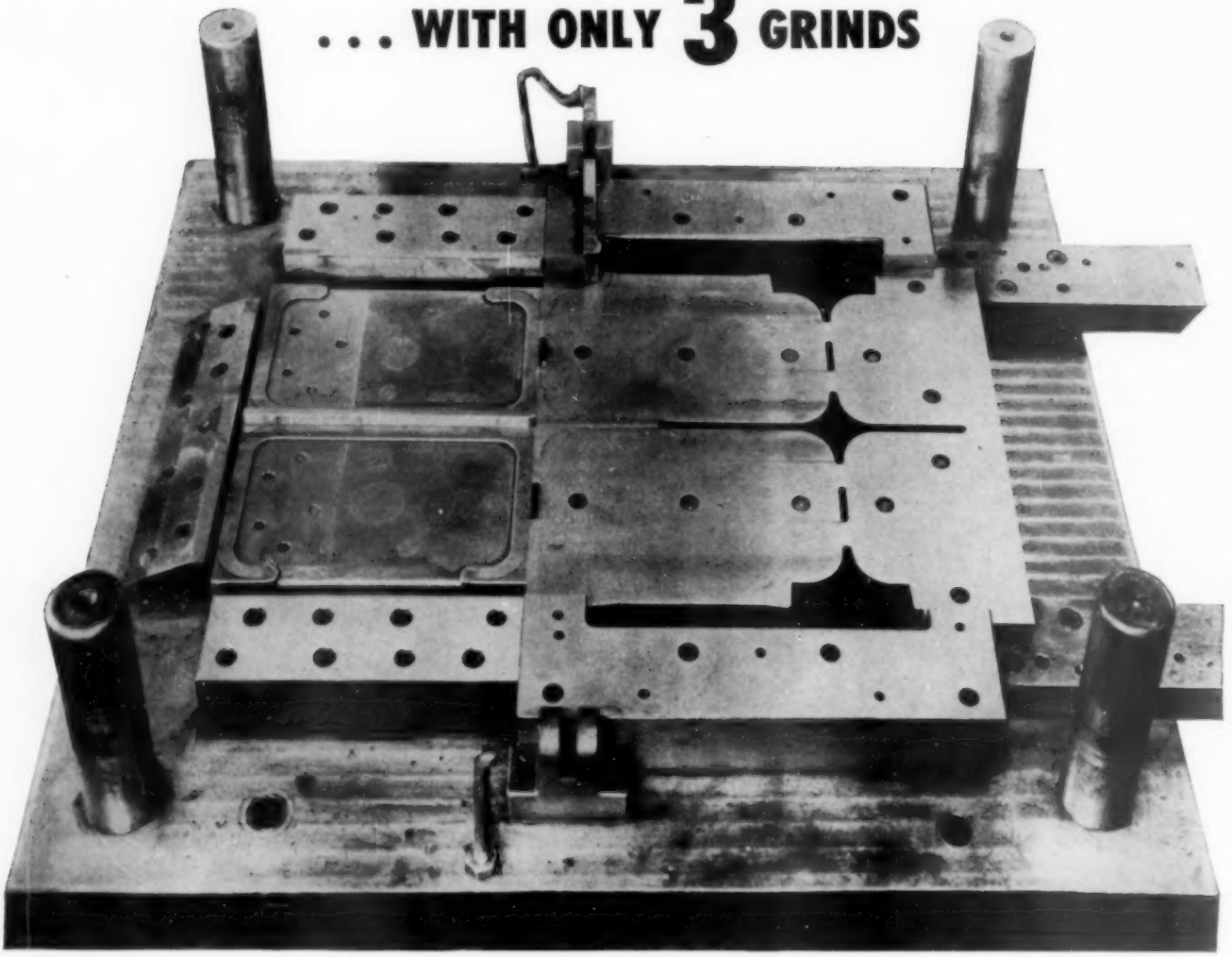
Write for Bulletin 55A giving complete details on Ingersoll inserted blade milling and boring tools.



THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

Blanked 1½ Million Pieces

. . . WITH ONLY 3 GRINDS



It's a big figure—but not unusual when Bethlehem's Lehigh H is the die steel. The die shown here and its companion top die—both made of Lehigh H—were used for blanking from 22-gage cold-rolled steel sheet. Tough steel at that—yet only three grinds were required on a job that exceeded 1½ million pieces.

That's a pretty good example of what Lehigh H can do for you. But there's one vital factor that the figures don't reveal; namely, the very low distortion and dimensional change under heat-treatment. This has always been an outstanding characteristic of Lehigh H. And a highly valuable one, when you consider what distortion can do to a costly die.

In addition, Lehigh H has high shock- and abrasion-resistance. Air-hardening, it's an aristocrat of the tool room, yet it isn't at all temperamental. Try this dependable performer on your really tough jobs.

SUGGESTED USES FOR LEHIGH H

Blanking, punching, and forming dies; master tools and hobs; mandrels, gages; bending and forming rolls.

TYPICAL ANALYSIS

C 1.50 V 0.40 Cr 11.50 Mo 0.80

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

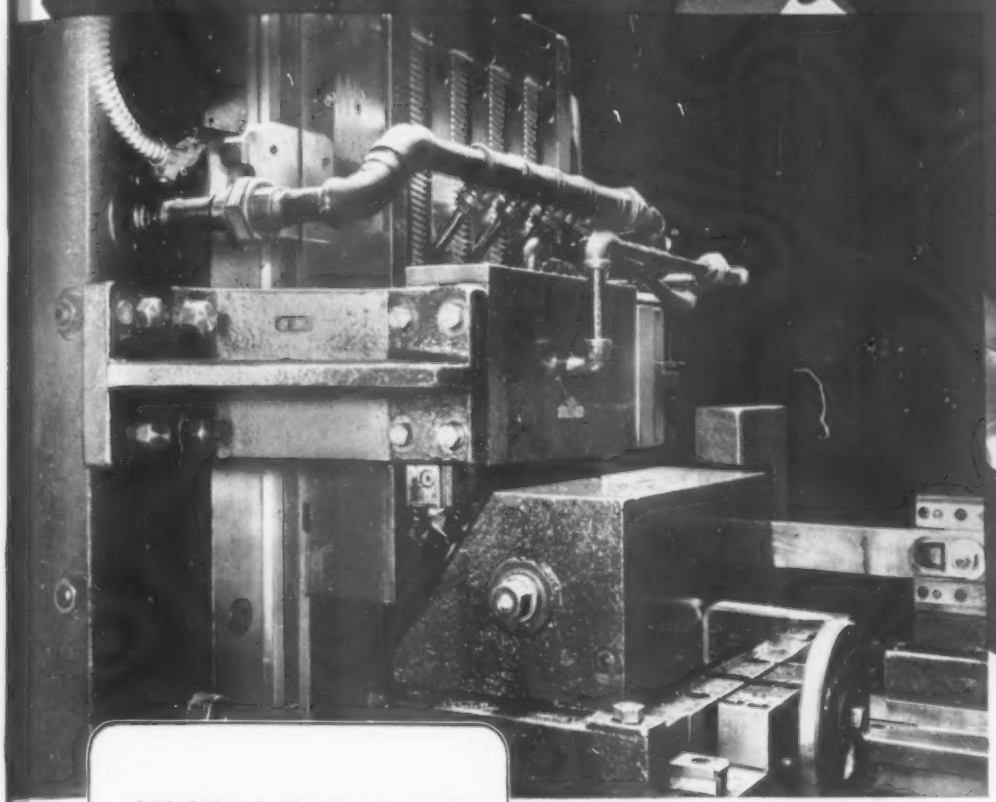
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

LEHIGH H TEMPER . . . one of Bethlehem's BIG 8 Tool Steels

MORE GOLD...

with Oilgear Fluid Power Broaching



ADVANTAGES OF OILGEAR BROACHING MACHINES

High broaching speeds, higher return speeds. Infinitely adjustable cutting and return speeds. More efficient use of electric power permitting smaller motors. More efficient use of the fluid medium, allowing oil reservoirs as little as 1/5th the size of others; more compact and usable machines. Wide and roomy tool slides and shuttle tables, manual, semi-automatic and full-automatic cycle control at no extra cost. Positive control interlock with fixture operation.

OILGEAR

In 1938, an Oilgear Surface Broaching Machine was sent up into the wilds of Canada, hundreds of miles from anywhere. It was to try its hand at sharpening rock drill bits used in Hollinger Consolidated Gold Mines Ltd. operations as against both hot milling and conventional steel sharpening.

Here is what happened: to date, this single machine has sharpened more than 4 million 551 thousand bits. It sharpens 175 bits per hour as against 70 by the hot milling method. With two men for the broaching and turning operations, it equals the output of three of the conventional steel sharpening machines with six men. Oilgear Broaching takes off less metal, yet gives sharper, cleaner edges, more efficient drilling. It averages 25,000 drill bits per tool regrind. Aside from a minor pump adjustment on March 18, 1939, it has required no maintenance whatsoever.

"(The) performance (of this Oilgear Broach) has been the main factor in our choice of another Oilgear machine for future operations," writes Mr. F. Wolnod of the Hollinger Company.

The gold you dig for may not come from mines. But you will get *more* "gold" if you turn to Oilgear Fluid Power Broaching. THE OILGEAR COMPANY, 1308 W. Bruce Street, Milwaukee 4, Wisconsin.

Oilgear manufactures a complete line of broaching machines . . . horizontal and vertical for every internal and external broaching operation

Oilgear Fluid Power

This Staples special design step reamer proved the economical solution to the precision reaming problem shown above. Reaming operation was done in turret lathe. To obtain the perfect concentricity and alignment required, the rear section of the tool has a specially modified 90° end sharpening—this causes tool to cut with end milling action, thereby correcting misalignment between the two diameters present after drilling.

In the production of these shaft housings, this Staples reamer combined both reaming operations—maintained perfect concentricity between diameters—held consistently to the close tolerances specified—and produced an excellent finish in the hole.

Staples *Special* and *Standard* tools provide the answer to economical hole production. If your production involves special tool designs, submit your specifications and part prints to Staples Tool Engineers—we welcome the opportunity to assist you to obtain maximum efficiency in precision hole production.

THE STAPLES TOOL COMPANY
CINCINNATI 25 OHIO

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES
END MILLS • SHELL END MILLS • DISTRIBUTORS IN MAJOR CITIES

REPUTATION . . .

IS QUALITY THROUGH THE YEARS

Quality is value insurance to the purchaser. Thus, reputation for quality is the sum total of countless thousands of full-value products and services, delivered uninterruptedly over a long period of years.

But to Behr-Manning, *lasting* reputation is more than time's stamp of approval for past performances. The needs of the future for progressively improved quality are to us a twofold challenge—a challenge in research and a challenge in methods engineering.

The first challenge is a stimulus to build ever better coated abrasives, which in turn will produce more units and finer finishes, faster, and at lower cost. The second is a crusade to bring to Industry's cost-stricken production lines the relief of lower-cost abrasive methods.

Dedicated to the accomplishment of these objectives, we enter our fourth quarter-century of quality and service to Industry.

BEHR-MANNING · TROY, N. Y.
(DIVISION OF NORTON COMPANY)

HANDLE AIR TOOLS FASTER AND EASIER

ARO Air Drill Model 7027 ... ¼" capacity. 7000 to 15,000 RPM. One of the wide range of ARO Air Tools for drilling, grinding, nut-setting, screwdriving and other production jobs.

...with ARO SPEED COUPLERS

Aro Speed Couplers are designed for easy "push on" attaching—for coupling an air hose to any air tool or device. They permit the use of many tools with one air line. The Aro Speed-Coupler swivels freely ... eliminates twisting and kinking of hose ... prolongs hose life. To detach, merely "pull off". It's leak-proof with a shut-off valve in Coupler which closes automatically when detached. No other valves necessary. Coupler cannot be accidentally detached.

Aro Speed-Couplers available in a complete line for use on air lines, water lines and steam lines. Precision-built ... dependable. Ask your Aro Jobber or write ... The Aro Equipment Corporation, Bryan, Ohio.

JUST— PUSH ON to connect it! PULL OFF to disconnect!

Specify

ARO

AIR TOOLS AND COUPLERS

Talide

(TUNGSTEN CARBIDE)

Drawing Dies

Talide Tungsten Carbide Dies outwear steel dies at least 20 times, and in many applications, the ratio is as high as 50 to 1.

Made from the hardest metal known, with great compressive strength, the wear on these dies after thousands of draws is almost negligible. Talide Metal needs little redressing, a factor which reduces down time by over 50%.

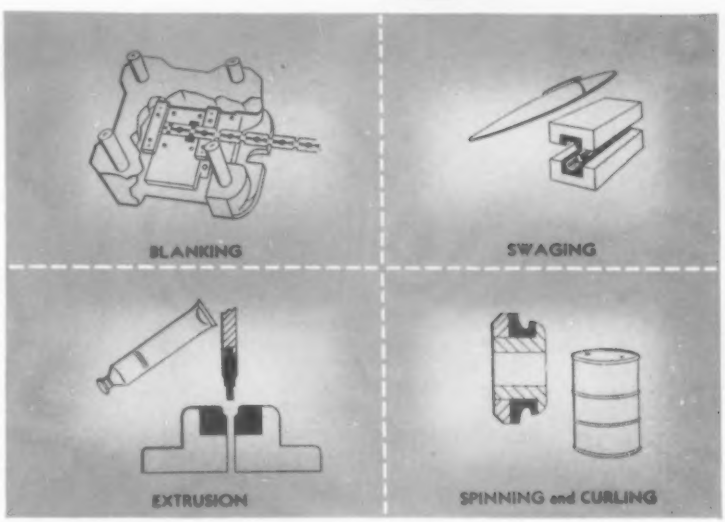
You can increase production, too, by taking much heavier drafts with Talide Dies, and by using the same Talide Drawing Die for two operations.

Talide Dies take and hold a brilliant finish, which imparts a better finish to your product and helps to eliminate scoring, galling, or pick-up. Scrap is reduced to practically nothing which increases by many thousands the number of pieces passing rigid inspection.

Original cost higher? Yes, but as for the advantages, the chief engineer of a prominent stamping plant has this to say:

"Our past experience proves to us that the original cost of Talide Dies is offset many times by the economy of long production runs."

Production men adapt Talide Dies for long production runs where steel dies wear out too fast or the service is too severe. See the illustrations here of typical applications of blanking, swaging, extruding, spinning and curling. The applications are almost endless. Write us about your particular application.



TALIDE METAL *meets every requirement*

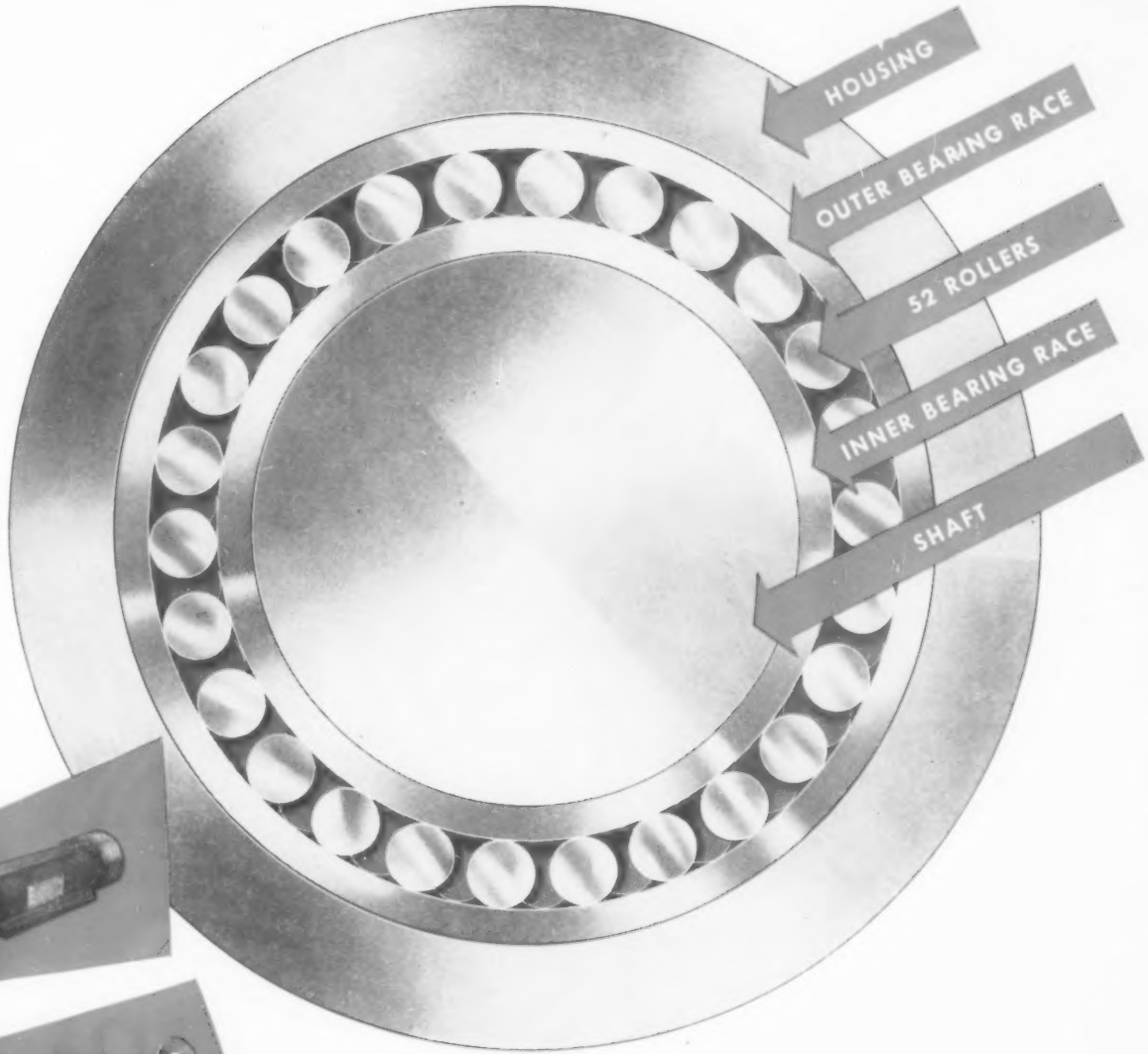
★ *Send for Die and Wear Part Catalog 46-WP.*

SINTERED CARBIDES
METAL CARBIDES CORPORATION
MC TALIDE
YOUNGSTOWN, OHIO
HOT PRESSED CARBIDES

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS



Pope Precision Grinding Spindles like these are equipped with double row roller bearings of enormous excess capacity, as shown above. Each bearing is given the exact radial preload to assure best grinding finishes and long life.

SEE FOR YOURSELF

Why POPE PRECISION SPINDLES *have* AMPLE ABILITY *to stand up under hard work*

Note the practically CONTINUOUS BEARING SUPPORT for the shaft provided by the SKF Double Row Roller Bearing. This insures the smooth running necessary for FINE FINISHES on ground surfaces.

And remember — these are ROLLERS you are looking at. For *rugged ability* to *carry loads easily* and *smoothly* for *long periods, there's nothing like a roller.*

No. 39

POPE

POPE MACHINERY CORPORATION

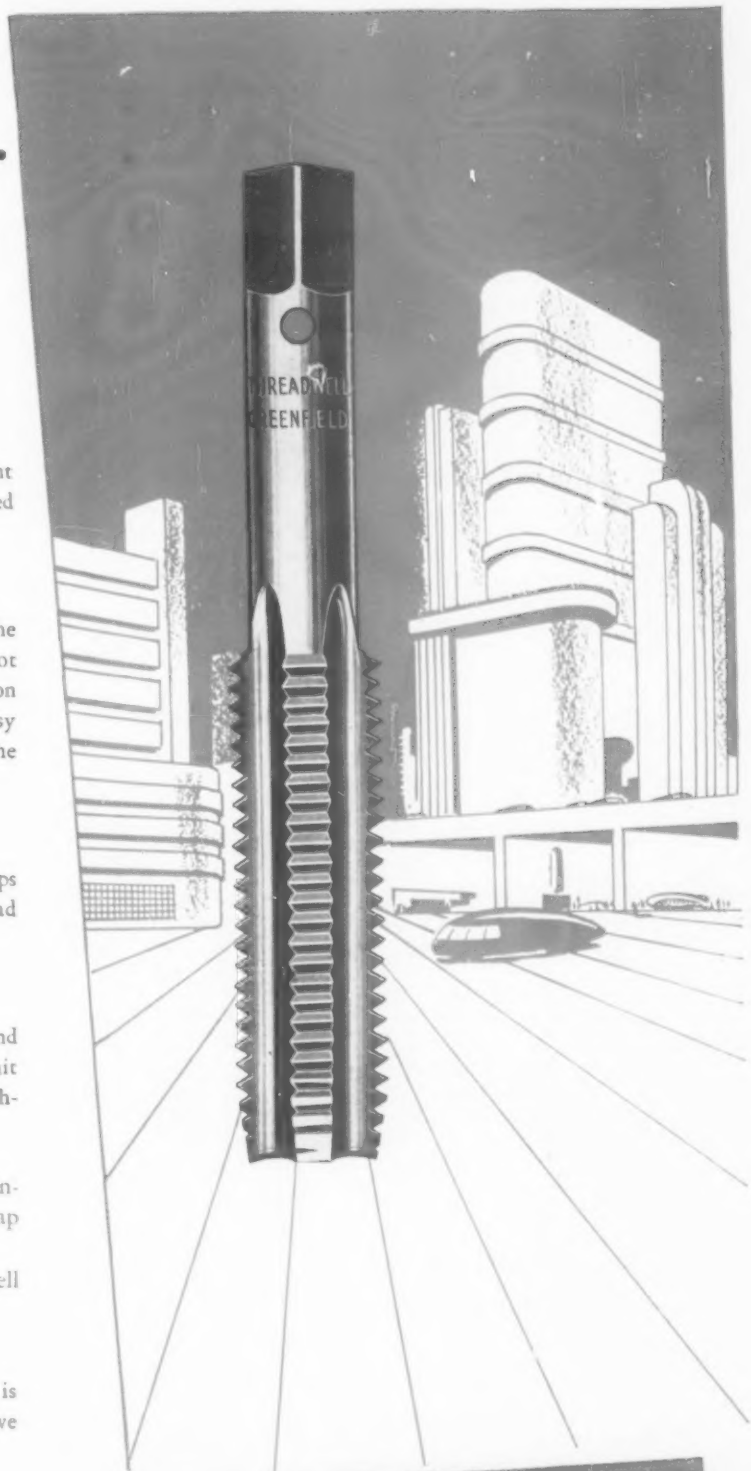
ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

WHY NOT SPECIFY 1947 MODEL TAPS...

Threadwell TAPS



Until *Threadwell* added:

COLD TEMPER deep-freeze treatment at 120° below zero to make high speed taps stronger but less brittle

"i-dot-ification" — *red* dot on the shank to identify cut thread, *white* dot on commercial ground, *blue* dot on precision ground — to make it easy for you to select the right tap for the job

Greaseless Rust-Proofing to keep taps always clean, dry and shining instead of messy and sticky to handle

Tap-Capsule to keep each ground thread tap clean and sharp and permit ready selection of type and size without unwrapping

Until *Threadwell* added these performance and convenience features, there hadn't been a change in tap "model" for years.

For up-to-the-minute threading you need Threadwell 1947 Model Taps.

THEY COST NO MORE

The Threadwell distributor in your neighborhood is ready to give you the best modern service, too. May we put you in touch with him?

DISTRIBUTORS IN LEADING INDUSTRIAL CENTERS THROUGHOUT THE UNITED STATES AND THE WORLD

Threadwell
SINCE 1902
"TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY • GREENFIELD, MASSACHUSETTS, U. S. A.

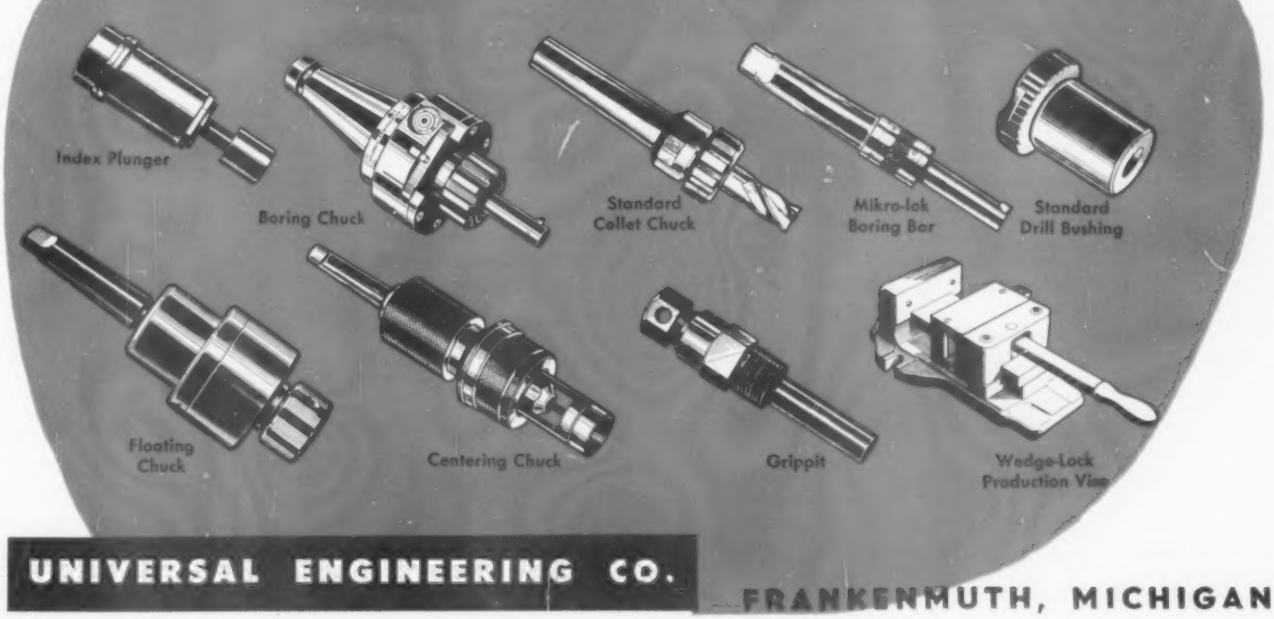
CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

SAVE TIME, SAVE MONEY! USE UNIVERSAL INDEX PLUNGERS IN ALL MULTI-STATION TOOLS

FOR ¼ THE COST OF SPECIAL INDEX PLUNGERS

You don't need to spend time and money machining special index plungers for your multi-station jigs and fixtures. Use Universal Index Plungers—they're made complete and ready to install, and they cost less than 25% as much as special-made plungers. They are available in taper design, for use where speedy location is of prime importance, and in straight design where more positive locking is desired and extra strength is necessary for indexing large and heavy jigs and fixtures. Both types have hardened and ground locating bushing, plunger, and plunger bushing for maximum resistance to wear. Made in four sizes to meet all normal jig and fixture requirements. Write for bulletin describing Universal Index Plungers in detail, and ask about any of the other superior Universal tools illustrated.

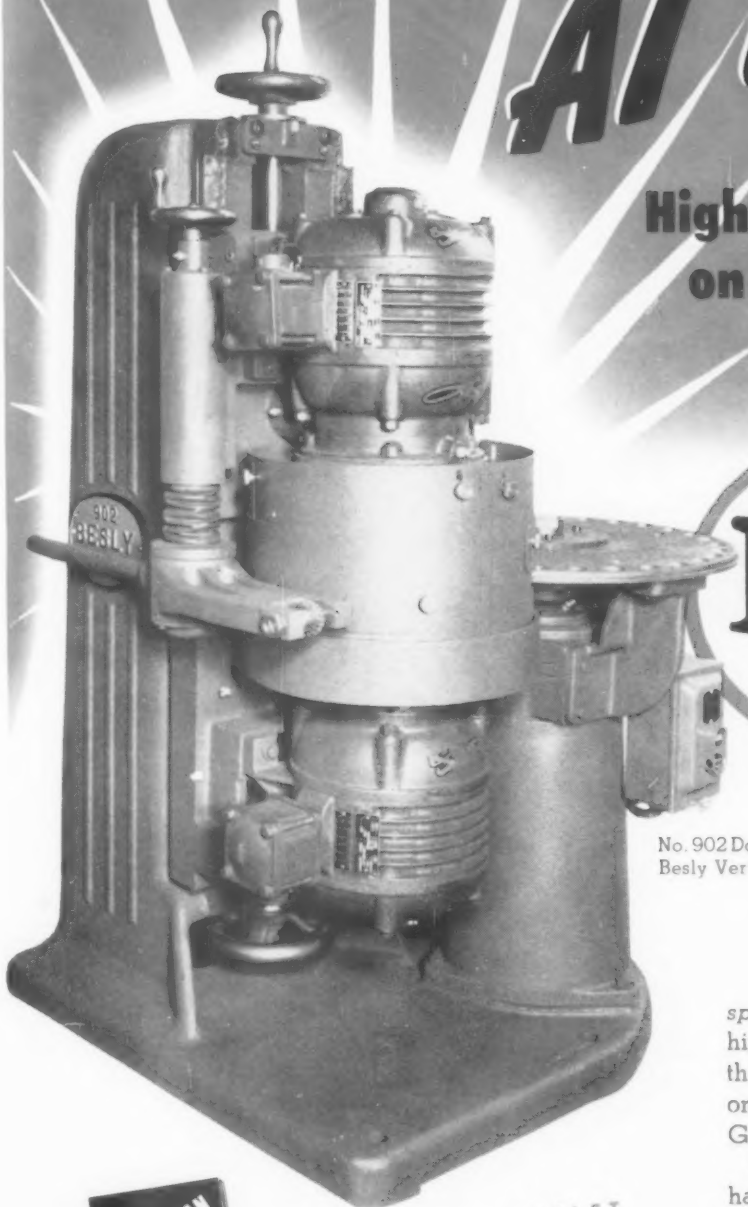
UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT.



UNIVERSAL ENGINEERING CO. FRANKENMUTH, MICHIGAN

AT LAST..

High Speed Output on Small Parts Grinding



No. 902 Double Spindle
Besly Vertical Grinder

BESLY
GRINDERS

The Grinding of small parts, previously difficult and slow on conventional double spindle disc grinders—can now be handled at new high speeds; small coil springs are ground at the rate of from 3,000 to 4,000 pieces an hour on this new-type Besly Double Spindle Verticle Grinder.

Revolutionary in design and appearance, it handles light coil springs, steel rollers, carbon brushes, washers, ceramic parts and an unlimited variety of other small pieces within allowable tolerances *at new low cost* and new high speed!

Besly engineers—with a background of 50 years experience—are ready to help develop the right grinder and abrasive to give you *better* finished parts—*faster—at lower cost.*

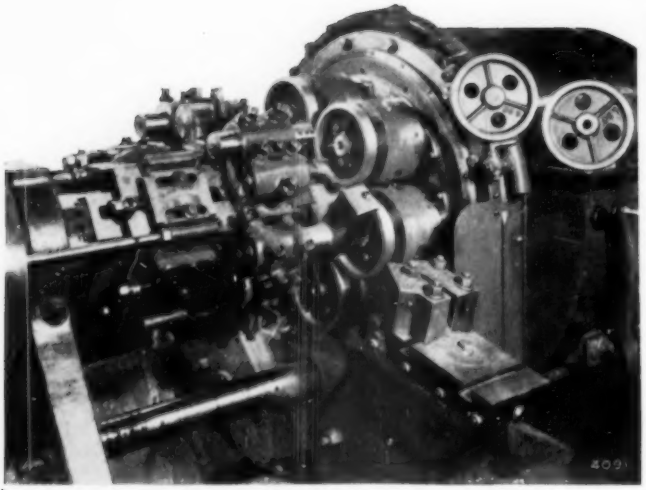
GET THIS FREE BOOKLET

It's a valuable source of information on modern grinding wheels and abrasives. Read about Besly Titan Steelbacs . . . they save "down time" and step up production.

BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHAS. H. BESLY & COMPANY, 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

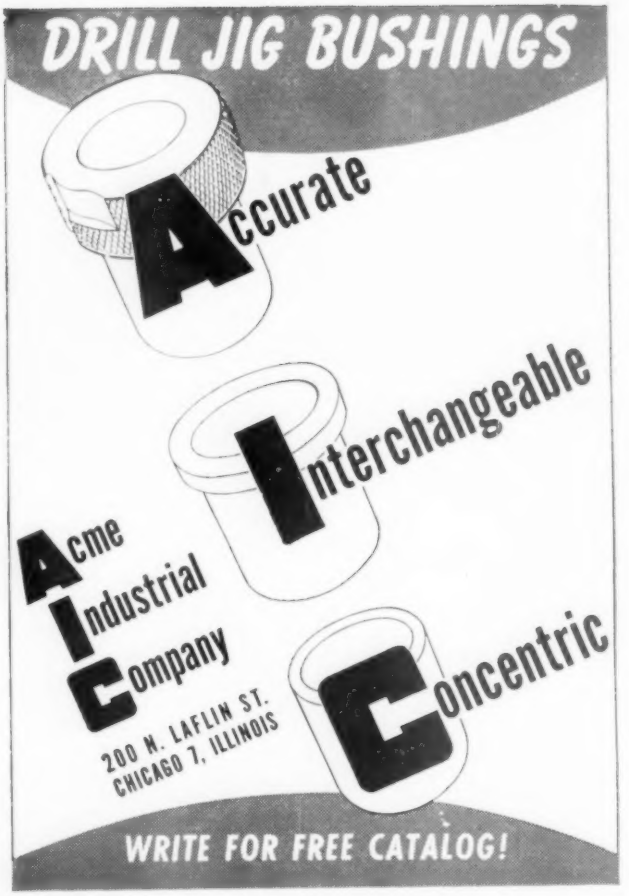
This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.



This RED BADGE of Merit

IS WELL-EARNED BY ALL PRODUCTS THAT WEAR IT

This "ribbon-etch" marks the products made by the longest-experienced manufacturer of cutting tools. And this mark means these 4 things:

1. It means that the product is made of special steel, usually from Simonds' own modern electric steel mills.

2. It means that the product is fabricated in the world's first windowless plant, where all working conditions are constantly controlled to keep workers' well-being and product-quality at top level.

3. It means that the product has been tested and re-tested to make sure you get full Simonds quality in every order. (There's no "second grade" in this line.)

4. It means that the product is represented, *to you,* by Simonds cutting-tool engineers . . . and by distributors and dealers . . . whose engineering judgment and sales counsel is as sound as the product itself.

And wherever this mark appears in *your* operations, *it will mark a deep cut in your cutting costs.*

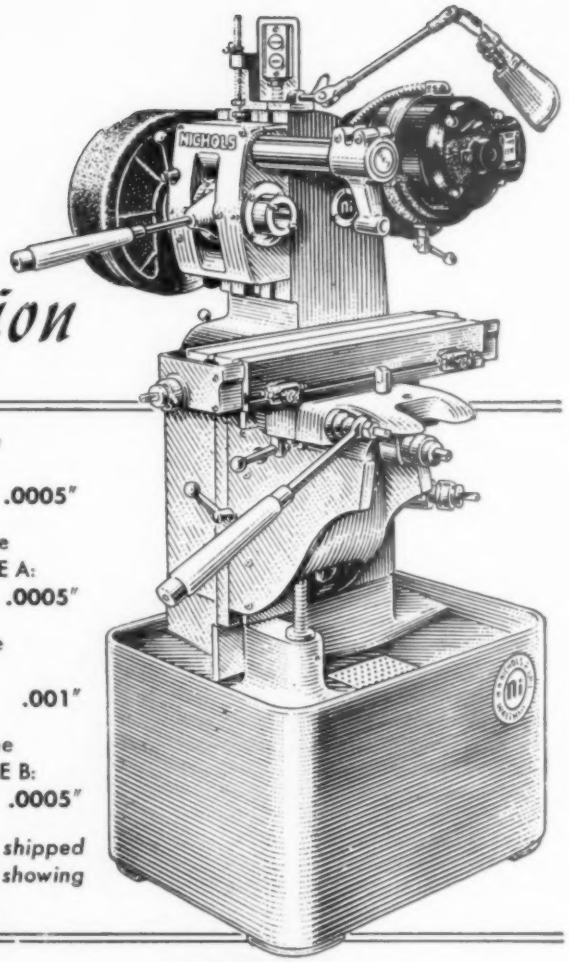
SIMONDS CUTS YOUR CUTTING COSTS ON METAL, WOOD, PAPER, PLASTICS

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS — Special Electric Furnace Steels
SIMONDS — Grinding Wheels and Grains
SIMONDS — Simonds Products for Canada

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30.

Puts the PRECISE *in Precision*



Spindle Taper Runout: Allowable Error	.00015″
Spindle Runout on 8″ Mandrel: Allowable Error	.001″ F.I.R.
Parallelism of Spindle to Table: With Error at Spindle Nose	.0000″
Allowable Error 8″ from Spindle Nose	—.0005″
Parallelism of Spindle to Top of Knee: Allowable Error	.001″
Right Angularity of Table to Spindle on 20″ TRAM: Allowable Error	.001″
Squareness of Head Slide to Top of Knee: Allowable Error	.0005″
Parallelism of Head & Knee Slides on Column, PLANE A: Allowable Error	.0005″
Squareness of Head Slide to Top of Saddle: Allowable Error	.001″
Parallelism of Head & Knee Slides on Column, PLANE B: Allowable Error	.0005″

Every Nichols Miller is shipped with an inspection sheet showing these tolerances or better.

Everything about the Nichols Miller has been done to make it as precise as precision can be. Built-in Accuracy . . . Rigidity . . . Speed — all are there ready to give you speed with precision on a single piece or in mass quantity — with Versatility limited only by the imagination of the tool engineer or the capacity of the machine itself.

CONDENSED SPECIFICATIONS

Table Working Surface	6¾″ x 21″ or 30″
Longitudinal Travel (screw or lever)	10″ or 19″
Transverse Travel (screw or lever)	7″
Vertical Travel — Knee	13½″
Rise and Fall of Spindle	4½″
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

√ RIGIDITY
Carefully designed, uniform-walled, box-type castings take full advantage of cast iron's strength.

√ VERSATILITY
A "basic" machine easily tooled to handle tool room or production milling within its capacity. Mounting the work in the spindle permits Second Operation boring and facing.

√ SPEED
For example, the Nichols Miller can turn out 1000 cuts an hour on one setup. Then, after a quick tool change, it can be ready for another job.

Send for your free copy of
"The Miller That Uses Its Head"

THE *Nichols* MILLER

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS: NICHOLS-MORRIS CORP., 46 CHURCH ST., NEW YORK 7, N. Y.

Announcing AN IMPORTANT ADVANCEMENT in MACHINING with *Carbide*

New OK INSERTED CARBIDE TIPPED TOOL BITS and HOLDERS

Adjustable for wear . . . Serrated for clamping security . . . Interchangeable for quick and easy replacement

SIX INTERCHANGEABLE shapes of tungsten carbide tipped tool bits for one holder — one right-hand and one left-hand tool bit for boring, turning and facing.

ADJUSTABLE — The first job-engineered inserted type carbide tipped tool bits adjustable to compensate for side wear.

SERRATED — The only carbide tipped tool on the market with the famous OK mated serrations on holder and inserts, to insure positive clamping and freedom from vibration.

QUICK CHANGE — If replacement is necessary for regrinding or next operation, simply stop machine, loosen set screw, insert the proper tool bit without disrupting your set-up, and proceed. All shapes of tool bits, size for size, have uniform tool height.

GREATER PRODUCTION — Changing from high speed tools to carbide increases production about four to one. Your low initial investment quickly pays for itself.

LOW COST — List price 400F Holder 1¼ inch shank, 1¼ inch tool height, $5.25. Set of six carbide tipped tool bits (three right and three left hand for boring, facing, turning) $30. In quantities of 50 and over as low as $3.45 net each tool bit. Other sizes in proportion. Holders come in five sizes: ⅝ inch, ¾ inch, 1 inch, 1¼ inch and 1½ inch square.

THE OK TOOL COMPANY, 30 Hull Street, Shelton, Conn. Division Aerodynamic Research Corporation

AMERICA'S NUMBER ONE INSERTED BLADE *Milling Cutters . . . Boring Tools . . . End Mills*

MICROHONING

is the Quicker, Better, Lower Cost Method

For Example:

THIS 4130 STEEL ROCKET TUBE, ROCKWELL 34-38C

Size: 4.220″ diameter x 20.5″ long.
Preceding Operation: Diamond Bore.
Average Stock Removed: .030″ on diameter
Average Time: 5.45 minutes
Average: 1.5 cubic inch per minute.
Average: .0055″ on diameter per minute.

Another Example:

Aircraft Propeller Blade Tubing

Size: 8.000″ diameter x 96″ long.

Preceding Operation: Drawn Seamless Tubing with scale in bore.

Average Stock Removed: .050″ to .080″ on diameter (approximately 156 cubic inch in bore).

Average Time Required: 65 minutes.

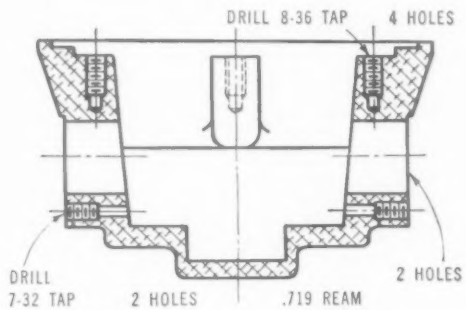
2063

MICROMATIC HONE CORPORATION • DETROIT 4, MICHIGAN

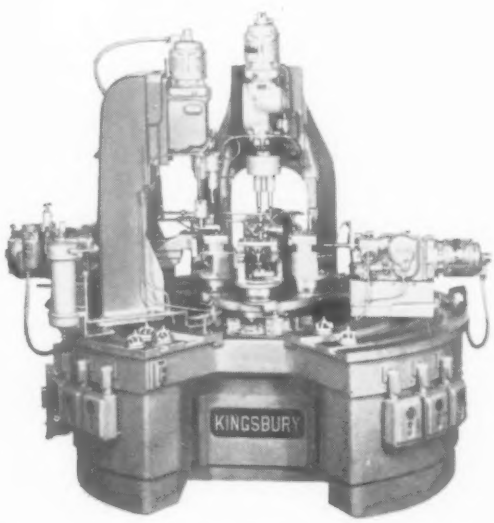
DISTRICT FIELD OFFICES: 1323 S. Santa Fe, Los Angeles 21, Cal. • 194 Dalhousie St., Brantford, Ont., Can. • 616 Empire Bldg., 206 S. Main St., Rockford, Ill. 501 Harries Bldg., 137 No. Main St., Dayton 2, Ohio • 927 A—M & M Bldg., P.O. Box 981, Houston 2, Texas • Room 514—129 Church St., New Haven 10, Conn.

Multiple Drilling for High Production

Problem Drill, tap and ream this die cast motor end bell. Accurate location is important.

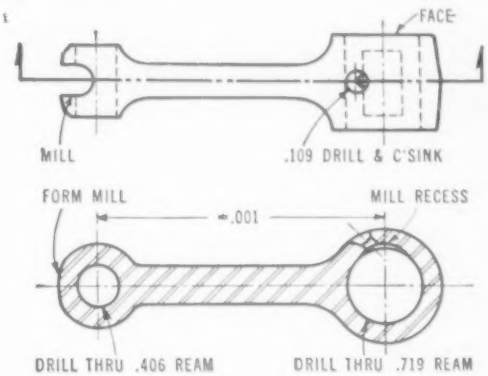


Method SPECIAL ROTATING FIXTURES make possible operations on both sides of the piece. In a single chucking, operations are performed progressively on one side at the three working stations, then the operator rotates the fixture 180° and the opposite holes are machined.

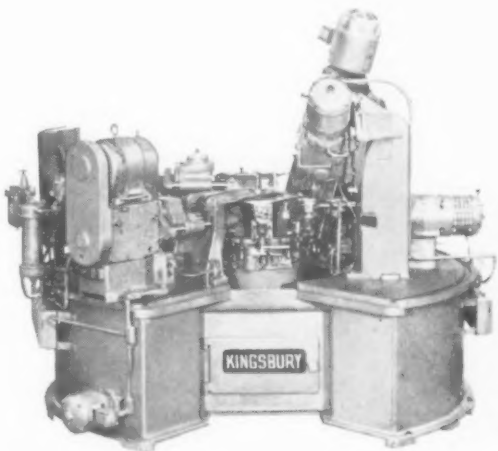


Results 220 PIECES PER HOUR GROSS and substantial savings costs. If your high production work requires multiple drilling up to an inch or so in diameter, let us propose a machine that will be completely designed and tooled ready to do your job. Send us a print and outline the operations and hourly production desired.

Problem Machine this forged steel connecting rod as shown.



Method THE HARD-TO-REACH RECESS is milled by means of a unique device that automatically tilts the head-unit upward to make a plunge cut at the proper time. The holes are accurately located because the work is not disturbed in the fixture between operations. The machine is a nine spindle "auto-index" with eight identical work fixtures.

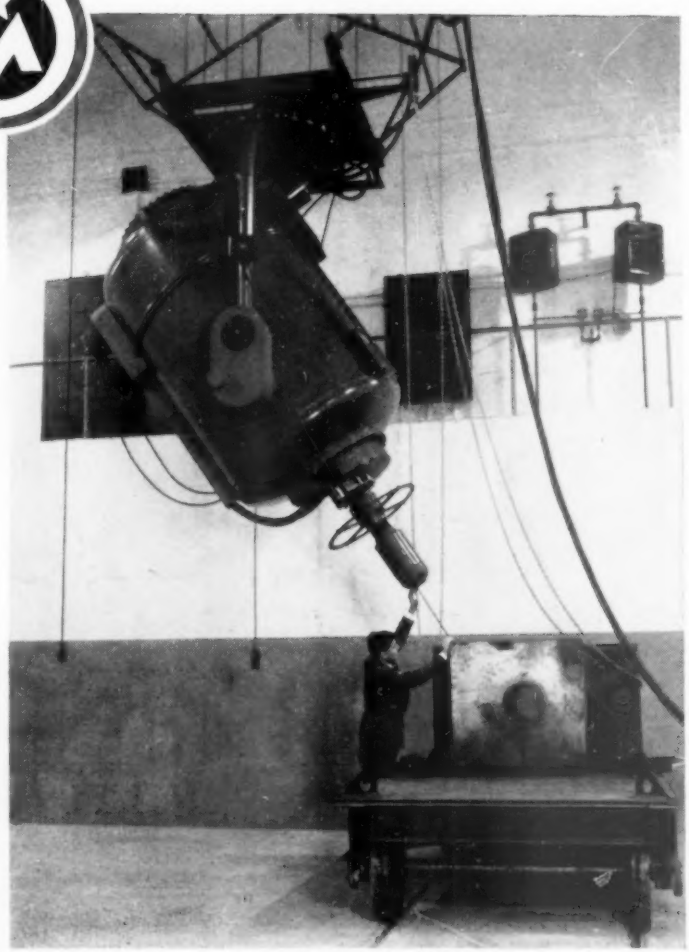


Results 150 PIECES PER HOUR GROSS. The unit cost is lower now because of more output per man hour, fewer rejections, less handling and less floor space. The initial cost is lower than most special purpose machines because the indexing, drilling and milling units and the base are all standard.

KINGSBURY MACHINE TOOL CORP., KEENE, N. H., U. S. A.

Kingsbury

OUR 2,000,000 VOLT ELECTRIC EYE



MIDVALE'S 2,000,000 volt X-ray tube is the only one of its size in use in any steel mill—a distinction indicating Midvale progressiveness, and soundness of inspection methods. This powerful eye pierces steel 12 inches thick . . . pictures the interiors of forgings, castings and other products . . . points out faults or perfection. And does it faster and surer than equipment of lesser voltage. You can lower the cost of your products—prove their quality and design—by *non-destructive* inspection, with Midvale's penetrating 2,000,000 volt X-ray eye.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO

MIDVALE
Custom Steel Makers to Industry

STAINLESS AND TOOL STEEL BARS
•
CORROSION AND HEAT RESISTING CASTINGS
•
FORGINGS AND RINGS

Here's Why

32 ALUNDUM Grinding Wheels Are Showing Such Startling Results

When ordinary abrasives are crushed to size it results in many grains with flat sides. When such grains are bonded into a wheel it is often a flat side that is exposed in the surface instead of a useful cutting point.

No crushing to size is necessary, however, with 32 ALUNDUM abrasive. The grains form as individual crystals—pointed on *all sides.* No matter how they are bonded into a wheel one or more cutting points are exposed. And they are longer-lasting cutting points because they are over 99% pure fused alumina.

The greater number of longer-lasting cutting points doing the work means that a 32 ALUNDUM grinding wheel removes stock more rapidly. Because grinding heat is spread over more points, and points that stay sharp longer, "32" wheels cut cooler. Because there are more points doing the work and points that don't dull quickly, 32 ALUNDUM wheels require fewer dressings and last longer.

Ask your Norton abrasive engineer for Vectograph Demonstration

Norton Company, Worcester 6, Mass.

NORTON ABRASIVES

CUT THRU ALL CARBIDE CLAIMS!

(Our own included)

Get PROOF on your own machines!

Improved TECO Cemented Carbide

gives
- More pieces between grinds
- More grinds per tool
- Less down time
- Lower tool cost

TYPICAL CASE

Part: Standard Railroad Car Wheel
Machine: Betts Wheel Borer
Operation: Boring
Diameter: 7″
Length: 7″
Depth of cut: 5/16″ average
Feed: 1/8″
Speed: 60 R.P.M. (maximum available)
PIECES PER GRIND: 475
Best previous production:
15 pieces (H.S.S. and similar alloys)*

Carbides were never successful on this job previously.

PERFORMANCE speaks louder than words or claims. We welcome examination of our claim that Improved TECO Cemented Carbide drastically outproduces other carbides. We urge you to compare Improved TECO with your present carbide, under identical working conditions. Then decide for *yourself* whether it is the most productive, most economical carbide you ever used.

Run a few tools tipped with Improved TECO, on any carbide job. Then check it against your previous production for pieces per grind . . . number of grinds per tool . . . pieces per tool . . . tool cost. Note, too, its ability to perform at higher speeds and feeds.

Consult with our tool engineers or send details of your job set-up for recommendation. Latest catalog and price list sent on request.

Improved
TECO
CEMENTED CARBIDE

TUNGSTEN ELECTRIC CORPORATION
570 39th Street, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

Proven Performance

SELLS 6 OUT OF 10 GRAND RAPIDS GRINDERS

Of every ten Grand Rapids Hydraulic Feed Surface Grinders sold, six are to customers already using Gallmeyer and Livingston grinding machinery.

Such customer acceptance and approval is proof of the quality of Grand Rapids Grinders.

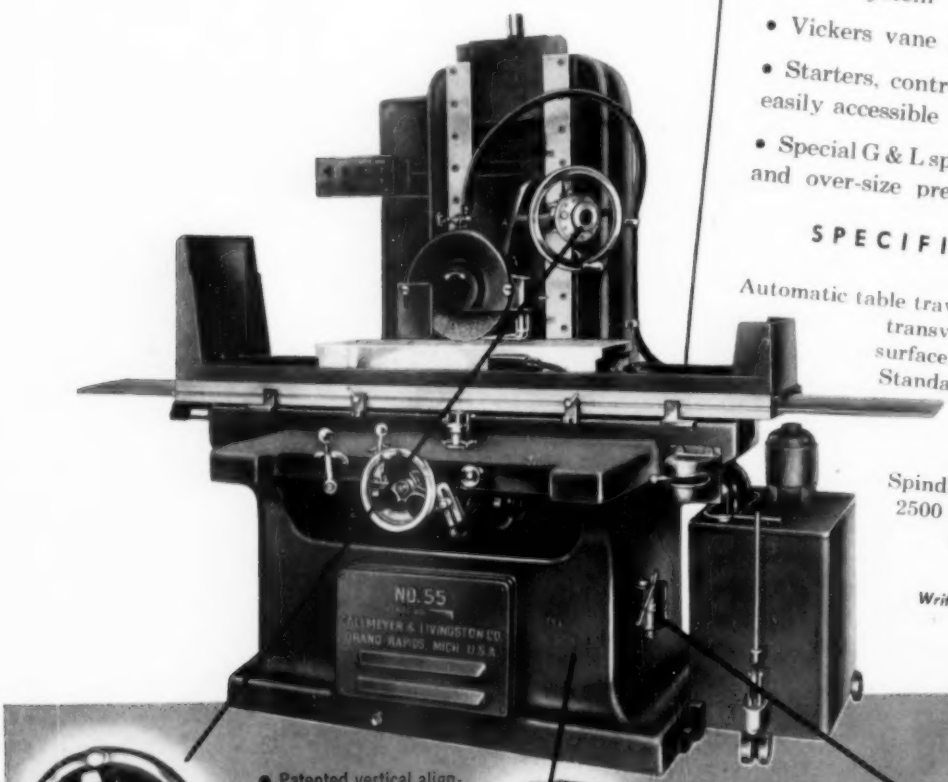
FEATURES

- 125 feet per minute longitudinal table speed
- Separate motors to drive grinding wheel spindle and hydraulic mechanism
- Two spindle speeds to reduce wheel costs
- Portable, self-contained motor driven coolant system
- Vickers vane type hydraulic pump
- Starters, controls and motors easily accessible
- Special G & L spindle motor end-bells and over-size precision ball bearings

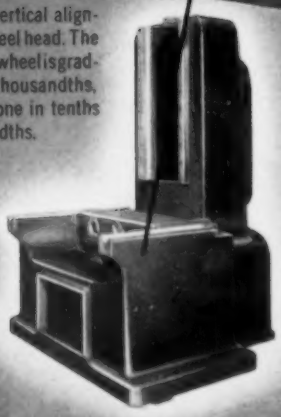
SPECIFICATIONS

Automatic table travel—longitudinal 38", transverse 13½" • Working surface of table—12" x 36" • Standard wheel size—12" x 1" x 3" • Vertical movement of wheel head—18" • Spindle speeds—1925 and 2500 RPM • Floor space —150" wide x 102" deep

Write for Bulletin GL 101



• Patented vertical alignment of wheel head. The large hand wheel is graduated in thousandths, the small one in tenths of thousandths.



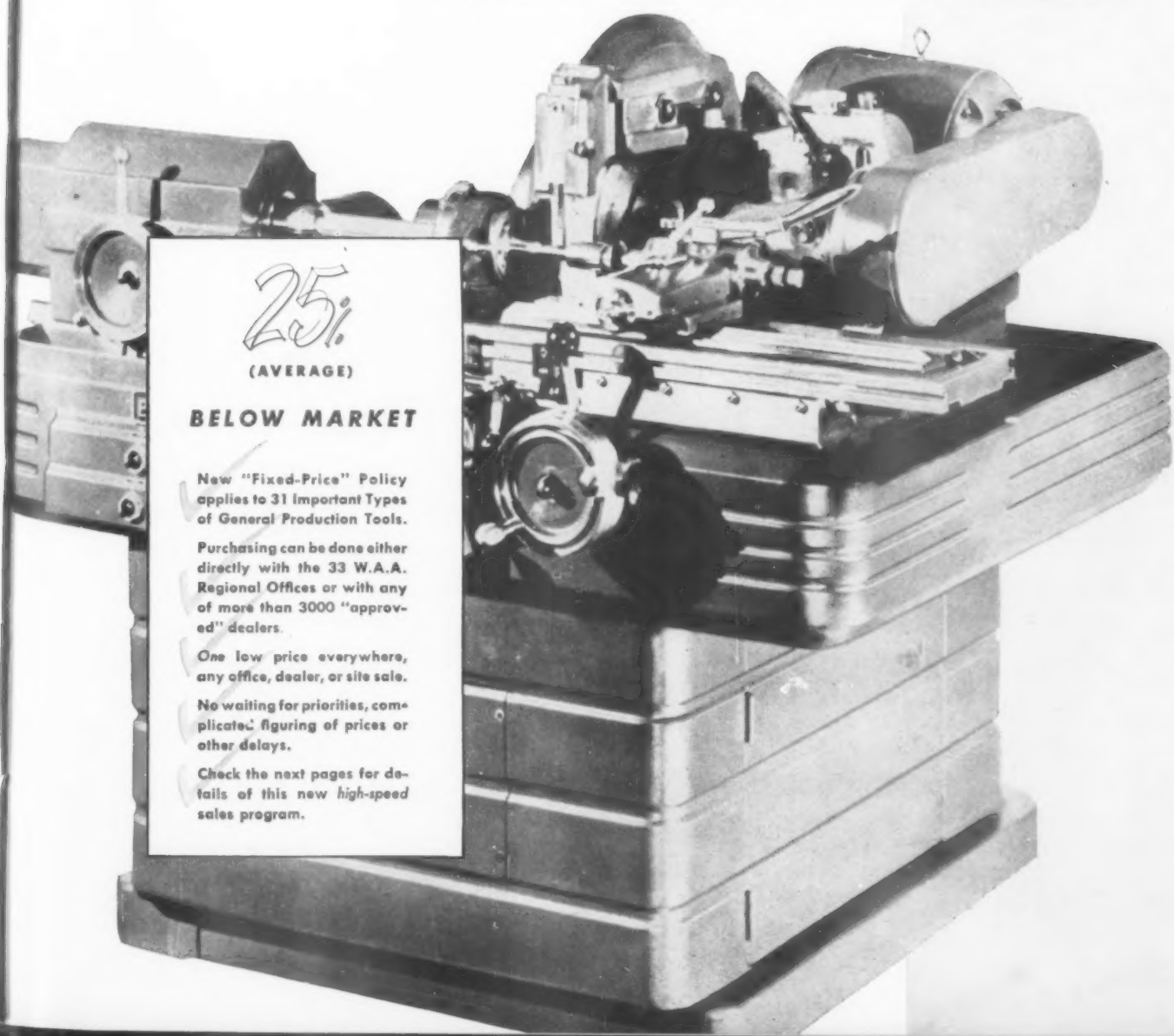
• Heavy, rugged, one-piece column and base of very close-grained gray iron, cast in our own foundry, assures permanent alignment between cross travel ways and vertical head ways.

• Bijur one-shot lubricating system insures long life for bearings, freedom from trouble and eliminates time spent in oiling.

GALLMEYER & LIVINGSTON COMPANY, 110 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICHIGAN

NOW YOU CAN REALLY *Buy*

SURPLUS MACHINE TOOLS



25%
(AVERAGE)

BELOW MARKET

New "Fixed-Price" Policy applies to 31 Important Types of General Production Tools.

Purchasing can be done either directly with the 33 W.A.A. Regional Offices or with any of more than 3000 "approved" dealers.

One low price everywhere, any office, dealer, or site sale.

No waiting for priorities, complicated figuring of prices or other delays.

Check the next pages for details of this new *high-speed* sales program.

BORING MACHINE — HORIZONTAL, PRECISION, BRIDGE TYPE, SINGLE END

Manufacturer: EX-CELL-O CORPORATION, DETROIT, MICH.

MODEL	SIZE AND CAPACITY	SALES PRICE
2112-A Single End	6" diameter bore, x 12" table travel	$ 720.00
2112-A Single End	6" diameter bore, x 15" table travel	655.00
112-C Single End	8" diameter bore, x 16" table travel	1036.00
112-C Single End	8" diameter bore, x 20" table travel	1139.00
Manufacturer: THE HEALD MACHINE COMPANY, WORCESTER, MASS.		
45 Bore-Matic, Standard, Single End	12" diameter bore, x 16" table travel	$ 1993.00
46-B Bore-Matic, Standard, Single End	9" diameter bore, x 14" table travel	1451.00
47-A Bore-Matic, Standard, Single End	9" diameter bore, x 13-5/8" table travel	1178.00
47-A Bore-Matic, Special, Single End	9" diameter bore, x 15" table travel	1186.00
48 Bore-Matic, Single End	6" diameter bore, x 9" table travel	714.00
48-A Bore-Matic, Single End	6" diameter bore, x 12" table travel	714.00
49 Bore-Matic, Standard, Single End	6" diameter bore, x 12" table travel	1116.00
Manufacturer: STOKERUNIT CORPORATION, MILWAUKEE, WIS.		
Mod. 1 Horizontal Single End	4" diameter bore, x 9" table travel	354.00
Mod. 2-B Horizontal, Single End	8" diameter bore, x 15" table travel	444.00

DRILL PRESS — FLOOR TYPE SINGLE OR MULTIPLE SPINDLE

(EXCEPT 110 VOLT, SINGLE PHASE)

Manufacturer: ALLEN—CHARLES C. ALLEN CO., BARRE, MASS.

MODEL	SIZE AND CAPACITY	SALES PRICE
HMD — Super Speed (Floor	5/16" drill capacity, 16" swing, 3 spindle	$ 511.00
HMD — Super Speed (Floor)	5/16" drill capacity, 16" swing, 4 spindle	657.00
HMD — Super Speed (Floor)	5/16" drill capacity, 16" swing, 6 spindle	$ 948.00
HMD — Super Speed (Floor)	5/16" drill capacity, 24" swing, 1 spindle	229.00
HMD — Super Speed (Floor)	5/16" drill capacity, 24" swing, 2 spindle	382.00
HMD — Super Speed (Floor)	5/16" drill capacity, 24" swing, 3 spindle	535.00
2-KH (Floor)	5/8" drill capacity, 14" swing, 1 spindle	$ 177.00
2-KH (Floor)	5/8" drill capacity, 14" swing, 2 spindle	279.00
2-KH (Floor)	5/8" drill capacity, 14" swing, 3 spindle	381.00
2-KH (Floor)	5/8" drill capacity, 14" swing, 4 spindle	483.00
2-KH (Floor)	5/8" drill capacity, 14" swing, 6 spindle	687.00
2-KH (Floor)	5/8" drill capacity, 24" swing, 1 spindle	$ 185.00
2-KH (Floor)	5/8" drill capacity, 24" swing, 2 spindle	295.00
2-KH (Floor)	5/8" drill capacity, 24" swing, 3 spindle	394.00
2-KH (Floor)	5/8" drill capacity, 24" swing, 4 spindle	513.00
2-KH (Floor)	5/8" drill capacity, 24" swing, 6 spindle	732.00
2-MSV (Floor)	7/8" drill capacity, 16" swing, 1 spindle	$ 240.00
2-MS (Floor)	7/8" drill capacity, 16" swing, 2 spindle	449.00
2-MS (Floor)	7/8" drill capacity, 24" swing, 2 spindle	469.00
2-MS (Floor)	7/8" drill capacity, 24" swing, 4 spindle	910.00
2-MS (Floor)	7/8" drill capacity, 30" swing, 3 spindle	718.00
2-V Belted (Floor)	7/8" drill capacity, 16" swing, 1 spindle	$ 184.00
2-V Belted (Floor)	7/8" drill capacity, 16" swing, 2 spindle	266.00
2-V Belted (Floor)	7/8" drill capacity, 16" swing, 4 spindle	440.00
2-V Belted (Floor)	7/8" drill capacity, 24" swing, 3 spindle	382.00
2-V Belted (Floor)	7/8" drill capacity, 30" swing, 1 spindle	196.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 16" swing, 2 spindle	$ 349.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 16" swing, 4 spindle	510.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 16" swing, 6 spindle	771.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 24" swing, 1 spindle	383.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 24" swing, 2 spindle	549.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 24" swing, 4 spindle	845.00
2-1/2 MSV (Floor)	1-1/8" drill capacity, 24" swing, 5 spindle	1033.00
3-V Belted (Floor)	1-1/4" drill capacity, 24" swing, 1 spindle	448.00
3-V Belted (Floor)	1-1/4" drill capacity, 24" swing, 2 spindle	649.00
3-V Belted (Floor)	1-1/4" drill capacity, 24" swing, 3 spindle	852.00
Manufacturer: AVEY DRILLING MACHINE CO., CINCINNATI, OHIO		
1-MA-6 Floor, Box Column	1/2" drill capacity, 15" swing, 1 spindle	$ 393.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 15" swing, 1 spindle	463.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 15" swing, 2 spindle	$ 648.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 15" swing, 3 spindle	852.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 15" swing, 4 spindle	936.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 24" swing, 4 spindle	910.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 24" swing, 5 spindle	877.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 24" swing, 6 spindle	$ 1044.00
2-MA-6 Floor, Box Column	7/8" drill capacity, 30" swing, 3 spindle	739.00
No. 3 Belted, Floor, Box Column	1" drill capacity, 24" swing, 1 spindle	349.00
3-MA-6 Floor, Box Column	1-1/8" drill capacity, 24" swing, 6 spindle	2122.00
3-MA-6 Floor, Box Column	1-1/4" drill capacity, 24" swing, 1 spindle	590.00
3-MA-6 Floor, Box Column	1-1/4" drill capacity, 24" swing, 3 spindle	$ 1041.00
3-MA-6 Floor, Box Column	1-1/4" drill capacity, 24" swing, 6 spindle	2122.00
3-BMA-1 Floor, Box Column	1-1/4" drill capacity, 24" swing, 1 spindle	279.00
3-BMA-1 Floor, Box Column	1-1/4" drill capacity, 24" swing, 3 spindle	754.00
No. 3 Standard Floor, Box Column	1-1/4" drill capacity, 24" swing, 3 spindle	614.00
No. 3 Standard Floor, Box Column	1-1/4" drill capacity, 24" swing, 4 spindle	791.00
Manufacturer: BUFFALO FORGE COMPANY, BUFFALO, N. Y.		
Model 14 Pedestal, Box Column, "High-Speed"	1/2" drill capacity, 14" swing, 1 spindle	$ 120.00
Model 2, Floor, Box Column, "Motor Spindle"	7/8" drill capacity, 16" swing, 1 spindle	243.00
Model 2 Floor, Box Column, "Motor Spindle"	7/8" drill capacity, 26" swing, 1 spindle	266.00

just look at these typical

Manufacturer: CANEDY-OTTO MFG. CO., CHICAGO HEIGHTS, ILL.

No. 5000-FV Floor, Box Column	3/8" drill capacity, 16" swing, 1 spindle	$ 172.00

Manufacturer: EDLUND MACHINERY CO., INC., CORTLAND, N. Y.

1-B-7" Floor Type	3/8" drill capacity, 14" swing, 1 spindle	$ 140.00
1-B-7" Floor Type	3/8" drill capacity, 14" swing, 2 spindle	239.00
1-B-7" Floor Type	3/8" drill capacity, 14" swing, 3 spindle	330.00
1-B-7" Floor Type	3/8" drill capacity, 14" swing, 4 spindle	391.00
1-B-7" Floor Type	3/8" drill capacity, 14" swing, 6 spindle	604.00
1-B-12" Floor Type	3/8" drill capacity, 24" swing, 1 spindle	$ 152.00
1-B-12" Floor Type	3/8" drill capacity, 24" swing, 3 spindle	348.00
1-B-12" Floor Type	3/8" drill capacity, 24" swing, 4 spindle	411.00
2-B- 8" Floor Type	3/4" drill capacity, 16" swing, 1 spindle	195.00
2-B- 8" Floor Type	3/4" drill capacity, 16" swing, 2 spindle	356.00
2-B- 8" Floor Type	3/4" drill capacity, 16" swing, 3 spindle	$ 524.00
2-B- 8" Floor Type	3/4" drill capacity, 16" swing, 4 spindle	691.00
2-B- 8" Floor Type	3/4" drill capacity, 16" swing, 6 spindle	1025.00
3-B-12" Floor Type	3/4" drill capacity, 24" swing, 1 spindle	208.00
3-B-12" Floor Type	3/4" drill capacity, 24" swing, 2 spindle	378.00
3-B-12" Floor Type	3/4" drill capacity, 24" swing, 3 spindle	$ 588.00
3-B-12" Floor Type	3/4" drill capacity, 24" swing, 4 spindle	775.00
3-B-12" Floor Type	3/4" drill capacity, 24" swing, 6 spindle	1019.00
2-MS-12" Floor Type	3/4" drill capacity, 30" swing, 2 spindle	468.00
4-B-12" Floor Type	1" drill capacity, 24" swing, 1 spindle	293.00

CHECK THIS COMPLETE LIST

If tools of the type *you* need are included send today for WAA's catalog giving all sizes and models together with the fixed prices for purchases made anywhere in the U. S. Simply write, wire or phone the nearest WAA office listed on the 4th page of this advertisement.

- Boring Machine—Horizontal, Precision, Bridge Type, Single and Double End
- Chucking Machine—Automatic, Vertical, Multiple Spindle Type
- Chucking Machine—Single Spindle Automatic, Horizontal Turret Type Machine
- Chucking Machine—Six Spindle Automatic, Horizontal
- Drilling Machine or Drill Press—Bench or Floor, Single or Multiple Spindle
- Gear Cutting Machine for Straight Bevel Gears, (Not Planer Type)
- Gear Hobber—Horizontal
- Gear Hobber—Vertical, Universal
- Gear Shaper—For External Spur Gears Only
- Gear Shaper—For Spur Gears, External or Internal
- Gear Shaper—For Spur and Helical Gears, External and Internal
- Gear Tooth Shaver—For External and Internal Gears (Rotary Type Machine)
- Gear Tooth Grinder—Generating Type, for Spur and Helical Gears
- Gear Tooth Grinder—For Spur Gears, External and Internal (Formed Wheel Type Machine)
- Grinders—Centerless
- Grinder—Crank Pin Grinders
- Grinders—Plain External Cylindrical Grinder
- Grinder—Internal, Cylindrical, Automatic Sizing
- Grinder—Internal Cylindrical (Hydraulic Feed Machine)
- Grinder—Internal Cylindrical, Hydraulic Feed, for Hole and Face Grinding.
- Grinder—Surface, Rotary Table Type
- Lathe—Multiple Tool, Not Automatic, Manufacturing Type Production Lathe
- Milling Machine—Automatic and Manufacturing Knee Type
- Milling Machine—Plain Bed Type, Horizontal Spindle Machines
- Milling Machine—Vertical, Knee Type (Not Including Bench Type)
- Polishing and Buffing Machine—Bench and Floor
- Profiling Machine—Vertical, Fixed Bed Type, Single and Multiple Spindle
- Tapping Machine—Vertical, Single or Multiple Spindle
- Thread Grinding Machines
- Thread Milling Machine
- Turret Lathe—Ram Type, Plain and Universal

ALL TOOLS SUBJECT TO PRIOR SALE

Manufacturer: FOOTE-BURT COMPANY, CLEVELAND, OHIO

Mod. DE [illegible] Box Column	3/16" drill capacity, 14" swing, 1 spindle	$ 127.00
Mod. [illegible] Box Column	7/8" drill capacity, 16" swing, 1 spindle	147.00
Mod. [illegible] Box Column	7/8" drill capacity, 16" swing, 2 spindle	255.00
Mod. [illegible] Box Column	7/8" drill capacity, 16" swing, 6 spindle	$ 706.00
Mod. [illegible] Box Column	7/8" drill capacity, 24" swing, 1 spindle	156.00
Mod. [illegible] Box Column	7/8" drill capacity, 24" swing, 2 spindle	274.00
Mod. [illegible] Box Column	7/8" drill capacity, 24" swing, 3 spindle	$ 391.00
Mod. [illegible] Box Column	7/8" drill capacity, 24" swing, 4 spindle	510.00
Mod. [illegible] Box Column	7/8" drill capacity, 24" swing, 6 spindle	745.00
Mod. [illegible] Box Column	1-1/4" drill capacity, 24" swing, 1 spindle	$ 279.00

Manufacturer: THE FOSDICK MACHINE TOOL CO., CINCINNATI, OHIO

No. 4 Floor Box Column	7/8" drill capacity, 24" swing, 1 spindle	$ 255.00
No. 4 Floor Box Column	7/8" drill capacity, 24" swing, 3 spindle	601.00
No. 4 Floor Box Column	7/8" drill capacity, 24" swing, 4 spindle	793.00
No. 4 B. M. Floor, Box Column	1" drill capacity, 16" swing, 1 spindle	$ 293.00
No. 4 B. M. Floor, Box Column	1" drill capacity, 16" swing, 2 spindle	293.00
No. 4 B. M. Floor, Box Column	1" drill capacity, 24" swing, 1 spindle	307.00
No. 4 B. M. Floor, Box Column	1" drill capacity, 24" swing, 4 spindle	1009.00
No. 5 B. M. Floor, Box Column	1-1/2" drill capacity, 24" swing, 1 spindle	$ 722.00
No. 5 B. M. Floor, Box Column	1-1/2" drill capacity, 24" swing, 2 spindle	790.00
No. 5 B. M. Floor, Box Column	1-1/2" drill capacity, 24" swing, 6 spindle	2219.00

IMMEDIATE DELIVERY bargains

25% (average) BELOW MARKET

Manufacturer: LELAND GIFFORD COMPANY, WORCESTER, MASS.

No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 12" swing, 1 spindle	$ 156.00
No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 12" swing, 2 spindle	274.00
No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 12" swing, 3 spindle	414.00
No. 1-LMS Bench, Motor Spindle	3/8" drill capacity, 20" swing, 1 spindle	147.00
No. 1-LMS Bench, Motor Spindle	3/8" drill capacity, 20" swing, 4 spindle	527.00
No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 20" swing, 1 spindle	168.00
No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 20" swing, 2 spindle	$ 308.00
No. 1-LMS Floor, Motor Spindle	3/8" drill capacity, 20" swing, 3 spindle	449.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 1 spindle	275.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 2 spindle	475.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 3 spindle	691.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 4 spindle	$ 907.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 5 spindle	1109.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 14" swing, 6 spindle	1312.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 20" swing, 1 spindle	285.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 20" swing, 2 spindle	491.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 20" swing, 3 spindle	$ 714.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 20" swing, 4 spindle	935.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 20" swing, 6 spindle	1349.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 1 spindle	297.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 2 spindle	514.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 3 spindle	$ 751.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 4 spindle	984.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 5 spindle	1206.00
No. 2-LMS Floor, Motor Spindle	7/8" drill capacity, 26" swing, 6 spindle	1426.00
No. 3-MS Floor, Motor Spindle	1" drill capacity, 24" swing, 1 spindle	$ 427.00
No. 3-MS Floor, Motor Spindle	1" drill capacity, 24" swing, 2 spindle	780.00
No. 3-MS Floor, Motor Spindle	1" drill capacity, 24" swing, 3 spindle	1154.00

Manufacturer: THE TAYLOR AND FENN COMPANY, HARTFORD, CONN.

Mod. S Floor, Box Column	3/8" drill capacity, 16" swing, 6 spindle	$ 477.00

Manufacturer: THE TOLEDO GENERAL MFG. CO., TOLEDO, OHIO

Model KTV Floor, Box Column	7/8" drill capacity, 24" swing, 4 spindle	$ 155.00

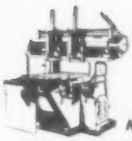
GRINDER — INTERNAL CYLINDRICAL, (HYDRAULIC FEED MACHINE)

Manufacturer: BRYANT CHUCKING GRINDER CO., SPRINGFIELD, VT.

MODEL AND DESCRIPTION	SIZE AND CAPACITY	SALES PRICE
Model 16-16 Internal Grinder, Hydraulic Feed	16" swing x 13" stroke	$1475.00
Model 16-22 Internal Grinder, Hydraulic Feed	22" swing x 13" stroke	1668.00
Model 16C-16 Internal Grinder, Hydraulic Feed	16" swing x 13" stroke	1647.00
Model 16F-28 Internal Grinder, Hydraulic Feed	28" swing x 13" stroke	$1766.00
Model 24-26 Internal Grinder, Hydraulic Feed	26" swing x 16" stroke	2051.00
Model 24-36 Internal Grinder, Hydraulic Feed	36" swing x 16" stroke	2427.00
Model 24L-26 Internal Grinder, Hydraulic Feed	26" swing x 24" stroke	$2589.00
Model 112M Internal Grinder, Hydraulic Feed	16" swing x 9" stroke	2292.00
Model 16-36 Internal Grinder, Gap Bed	36" swing x 9" stroke	1800.00

Manufacturer: THE HEALD MACHINE COMPANY, WORCESTER, MASS.

Model 81 Plain Chucker, Internal Grinder, Hydraulic Feed	9" swing x 3" stroke	$1122.00
Model 72-A-3 Plain Chucker, Internal Grinder, Hydraulic Feed	11-1/2" swing x 12" stroke	1327.00
Model 72-A-5 Plain Chucker, Internal Grinder, Hydraulic Feed	11-1/2" swing x 20-5/8" str.	1415.00
Model 74 Plain Chucker, Internal Grinder, Hydraulic Feed	24" swing x 15" stroke	$1940.00
Model 172, Gap, Plain, Internal Grinder, Hydraulic Feed	36" swing x 13" stroke	1778.00



PROFILING MACHINE — VERTICAL, FIXED BED TYPE, SINGLE AND MULTIPLE SPINDLE

Manufacturer: THE FREW MACHINE COMPANY, PHILADELPHIA, PA.

MODEL AND DESCRIPTION	SIZE	SALES PRICE
No. 6-A Single Spindle	24" x 36" table size	$ 793.00

Manufacturer: MOREY MACHINERY COMPANY, INC., NEW YORK, N. Y.

No. 12-M Single Spindle	23" table travel	$ 705.00
No. 12-M Two Spindle	23" table travel	742.00

Manufacturer: PRATT AND WHITNEY DIVISION, HARTFORD, CONN.

No. M-1693 Single Spindle, No. 12-B	20" table travel	$ 731.00
No. M-1693 Two Spindle, No. 12-B	20" table travel	844.00
No. M-1482 Single Spindle	32" table travel	1673.00

GEAR TOOTH GRINDER — GENERATING TYPE, FOR SPUR AND HELICAL GEARS

Manufacturer: THE FELLOWS GEAR SHAPER CO., SPRINGFIELD, VT.

MODEL AND DESCRIPTION	SIZE AND CAPACITY	SALES PRICE
No. 12 Spur and Helical, External only	12" pitch diameter x 1-1/2" face width	$ 1117.00

Manufacturer: PRATT AND WHITNEY DIVISION, HARTFORD, CONN.

M-1635 Spur	10- 1/4" pitch diameter x 6" face width	$ 1791.00
M-1639 Helical	10-11/16" pitch diameter x 6" face width	2528.00
M-1679 Helical, Two Wheel	10-11/16" pitch diameter x 1-1/4" face width	3300.00
M-1838 Helical	10- 1/2" pitch diameter x 6" face width	4292.00

GOVERNMENT WAA SURPLUS

Sales to priority claimants, which include Federal Agencies, Certified Veterans, World War II, and subsequent priority claimants, will be made in proper sequence as required by law.

Exporters: Your business is solicited. If sales are conducted at various levels, you will be considered as a wholesaler. Any inquiries regarding export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

. . . and no priorities needed

To make purchases visit any of the W.A.A. offices listed below; your regular machine tool dealer, or any W.A.A. Machine Tool Site Sale advertised in your local paper. You can arrange on the spot for immediate purchase. Remember, however, that the particular machine you want may be located elsewhere and shipping times these days are still uncertain. But you will *not* have to wait for lengthy clearances of priorities on nation-wide search of stocks. The machines *are* available for immediate sale.

W.A.A. announced last month its important New Price Policy on 31 types of General Production Tools.

But just as a reminder here is how W.A.A.'s new price has been set for a typical machine; Model 2K Kearney and Trecker Milling Machine, vertical knee type; W.A.A. S.C. Code 3417-23-20-28.

Price (New)	$7,054.00
Previous W.A.A. Sales Price (based on depreciation primarily)	4,091.00
Average Market Value	2,556.00
New W.A.A. Sales Price	2,045.00
Available for rebuilding	511.00

GOVERNMENT W A A SURPLUS

THERE IS A
WAA REGIONAL OFFICE
NEAR YOU

(starred offices have the longest and most complete inventories of surplus machine tools—but stocks are extensive in *all* offices. Watch your newspaper for special machine tool sales in your area).

Offices located at:

Atlanta	Helena	Omaha
Birmingham	Houston	*PHILADELPHIA
*BOSTON	Jacksonville	Portland, Ore.
Charlotte	Kansas City, Mo.	Richmond
*CHICAGO	Little Rock	Salt Lake City
Cincinnati	Los Angeles	*ST. LOUIS
*CLEVELAND	Louisville	San Antonio
Dallas	Minneapolis	San Francisco
Denver	Nashville	Seattle
*DETROIT	New Orleans	Spokane
Fort Worth	*NEW YORK	Tulsa

MACHINE TOOL
SALES DIVISION

686-2

WAR ASSETS ADMINISTRATION

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Your First Choice Steel for Impact Strength, Toughness and Better Surface Conditions

It's the combination of chrome and vanadium in Green Label, that produces an Oil Hardening Steel you can work readily, heat treat uniformly and count on for remarkable shock-resistance—the ideal characteristics for your high stressed machinery parts which are heat treated after machining. If you're looking for fine grain that assures better surfaces, minimum distortion in heat treatment and less tendency to crack during grinding, you'll find none better than this electric furnace, low carbon chrome vanadium steel. Green Label is furnished in a brinell hardness of 179 to 217 and hardens in oil to Rockwell C 54-56; tensile strength of 250,000 to 275,000 lbs. p.s.i. Available for prompt delivery. Write or call for your copy of our catalog.

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ERIE: Industrial Metals & Products Co., 934 W. 9th St. ROCKFORD, ILL.: Rockford Industrial Supply Co.

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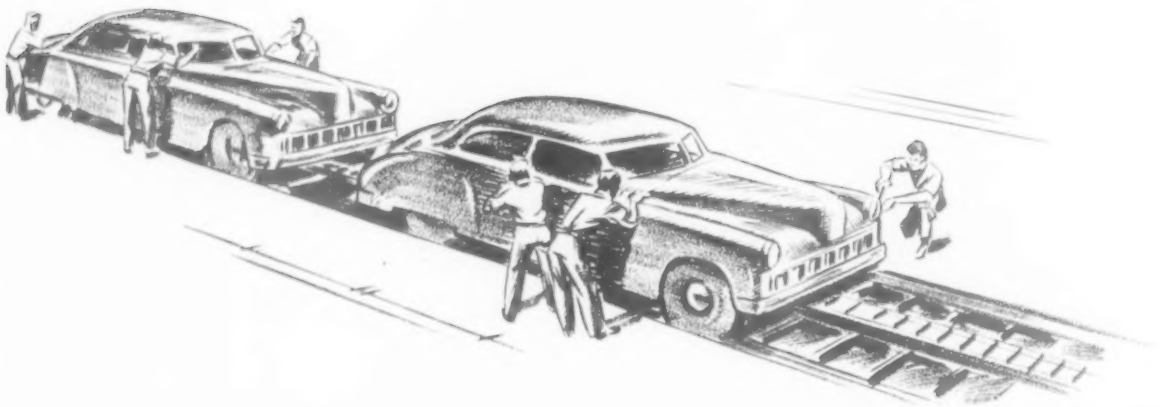

Leadership BUILDS ON *Craftsmanship*

For more than four decades, in all branches of the metal-working industry—and more recently in the plastics field—WINTER Taps have helped to make craftsmanship possible. The closer threading tolerances, cleaner threads, longer service between grinds, and extra tap life obtained from WINTER Taps are a natural result of Winter Brothers untiring research and constant laboratory testing. For greatest production at lowest tap cost, specify WINTER Taps.

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You get top quality both in your cutting tools and in the work they do when you specify NATIONAL. NATIONAL Counterbores (shown below) are the result of 43 years of specialized experience in the design and manufacture of Rotary Metal-Cutting Tools. For the best in high speed steel and carbon steel Twist Drills and Reamers, high speed steel Milling Cutters, End Mills, Hobs, Counterbores, and Special Tools—always ask for NATIONAL.

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Index of Tool Engineer Advertisers

January 1947

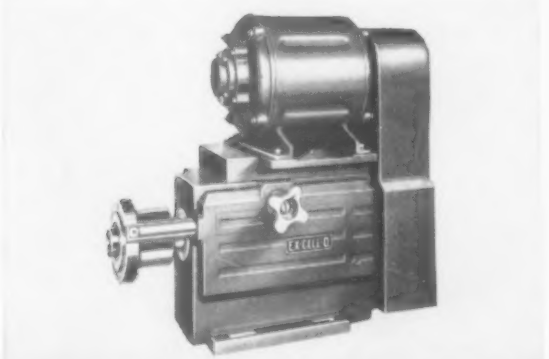
It's New! It's Small! It's Hydraulic!

Ex-Cell-O Style 20 Hydraulic Power Unit. The spindle nose has a straight hole with a keyway and set screw. The quill is provided with oil holes and a pilot diameter for flange mounting to other machining units.

EX-CELL-O Style 20 Hydraulic Power Unit for High Spindle Speeds and Fast Operating Cycles . . .

Ex-Cell-O's Style 20 Hydraulic Power Unit is designed for the high spindle speeds required for operating small diameter tools efficiently. It is built to stand up under continuous, fast operating cycles. The automatic cycle includes rapid approach, two infinitely variable dial adjustable feed rates, and rapid return and stop. The unit is arranged for electric start and emergency return control.

All Ex-Cell-O Hydraulic Power Units are easily installed; easily rearranged when production needs change. As a result, it is possible to use the units over and over again, and spread the original cost through years of operation. The units require minimum maintenance; ordinarily, the only care necessary is the replenishing of the hydraulic oil.



TWO OTHER SIZES—MEDIUM AND LARGE

Ex-Cell-O makes two other size hydraulic power units—(above) Style 21 (over-all length, without guard, 22¼") and (below) Style 28-A (over-all length, without guard, 38¼"). They are compact and self-contained for ease in installation. They have infinite feeds for proper cutting and provide ample power for multiple-head operation. Contact your local Ex-Cell-O representative today to see how Ex-Cell-O Power Units fit into your production program.

47—2

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EX-CELL-O for PRECISION

Ask For This FREE Book Now!

New Ex-Cell-O Bulletin gives full details on all Ex-Cell-O Hydraulic Power Units. Shows how they can be profitably applied to your production problems. Write for a copy today . . . ask for Bulletin No. 45361.

EX-CELL-O CORPORATION

DETROIT 6
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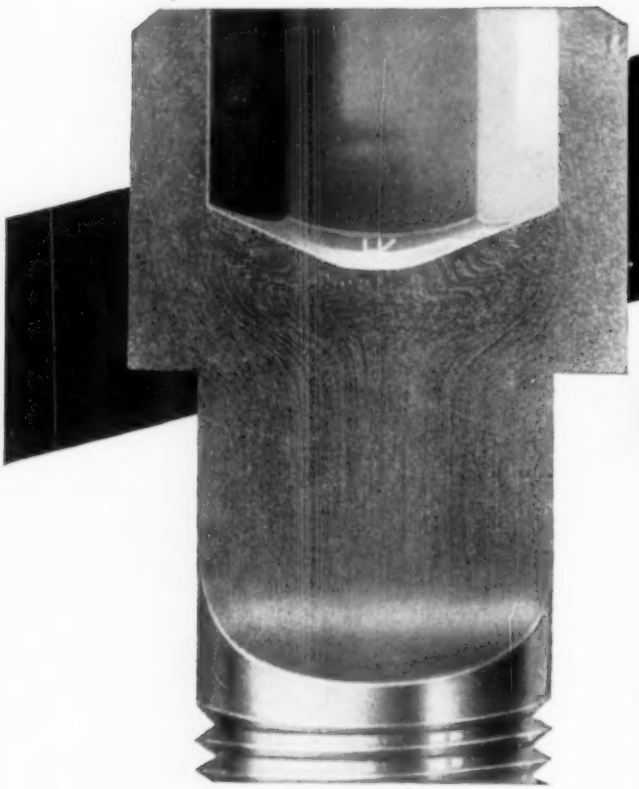
MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS • FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • PURE-PAK PAPER MILK BOTTLE MACHINES

UNRETOUCHED PHOTO ETCHED CUTAWAY
HOLO-KROME SOCKET HEAD CAP SCREW



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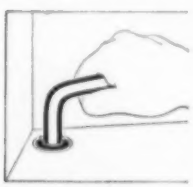
THE HOLO-KROME SCREW CORP.
HARTFORD 10, CONN. U. S. A.

INTERNAL WRENCHING



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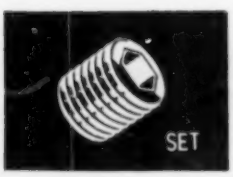
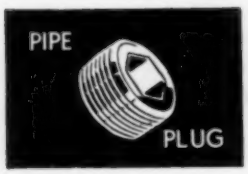
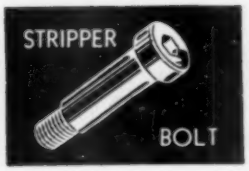


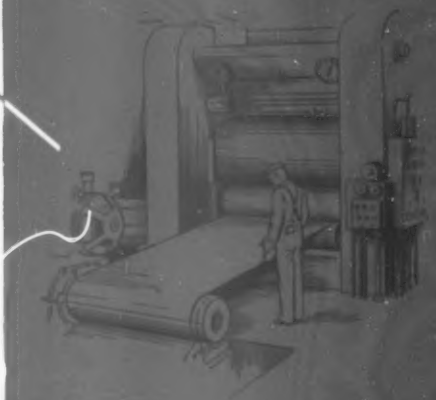




THE SHEFFIELD MEASURAY

MEASURES THICKNESS CONTINUOUSLY WITHOUT TOUCHING THE WORK

METALS
Sheet · Strip · Foil



RUBBER · PLASTICS
COATED FABRICS
FILMS · PAPER

Problems inherent in contact gaging of continuous strip materials are completely eliminated by the installation of the Sheffield Measuray. *No part of the Measuray touches the work.*

Whether it be hot or cold metal strip, or non-metallic materials, the Measuray provides amplification and sensitivity to check thickness to accuracies beyond any known industrial requirements.

The Measuray may be traversed across the moving sheet to obtain a check at any point, or an average check. It can be adapted to actuate an indicator, signal lights, or a recorder, singly or simultaneously.

A combination of X-Ray and electronics is used as the gaging principle to measure the mass—therefore temperature, weaving of the stock, speed of motion, and proximity of the gaging head to the work are relatively unimportant factors. The Measuray conforms to the safety standards of American Standards Association and National Bureau of Standards.

Write for complete information. Better yet, bring samples to Sheffield in Dayton and check them on the Measuray.

For an early installation (orders exceed production) see the Measuray in action and arrange for a Sheffield factory representative to visit your plant and draw up plans for your application.

Standard gages and measuring instruments shipped within 24 hours.

SHEFFIELD MASTER CRAFTSMEN

Real job security is provided only by plentiful incoming orders shipped at prices consumers can afford and want to pay . . . modern machines help make this possible.

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS · GAGES · MEASURING INSTRUMENTS · CONTRACT SERVICES

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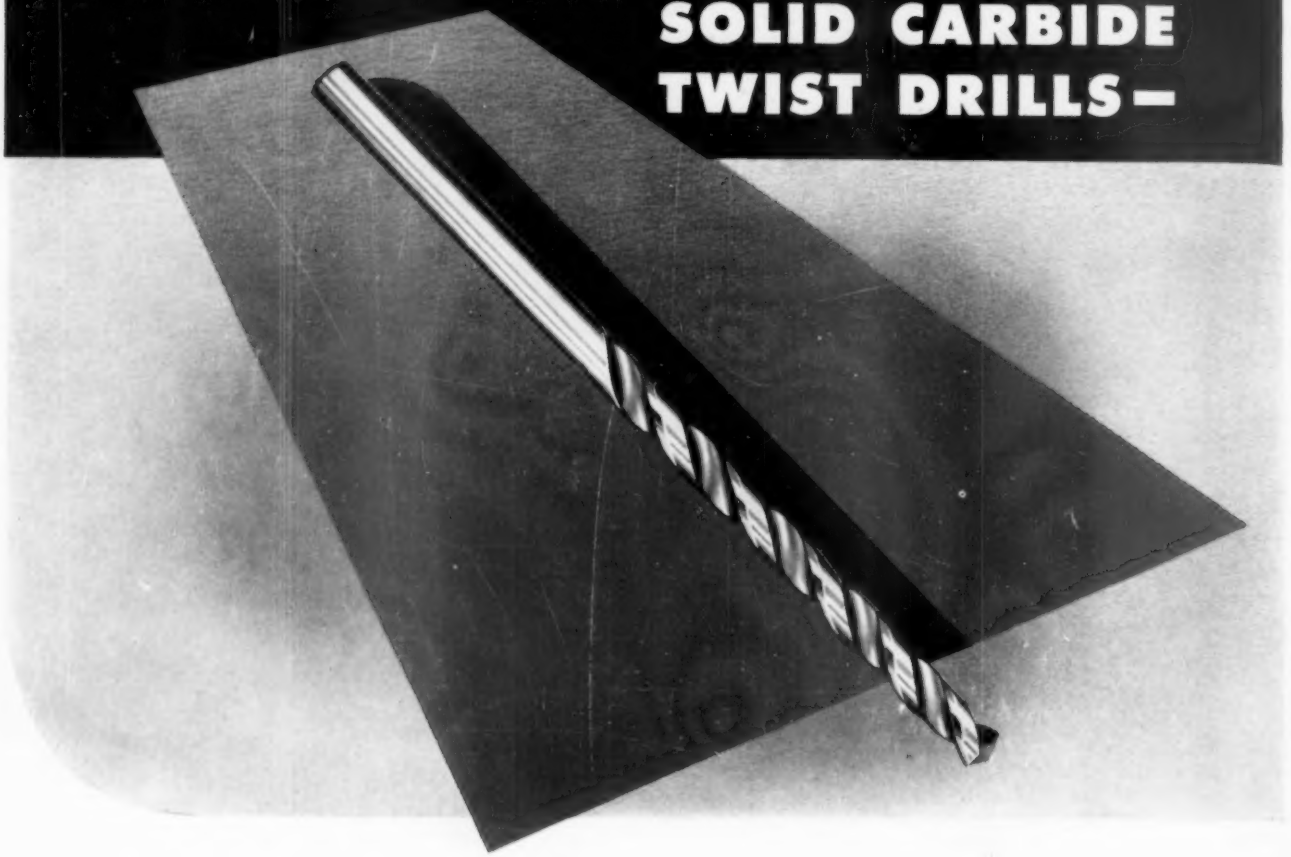
DRILL HIGHLY ABRASIVE MATERIALS WITH SOLID CARBIDE TWIST DRILLS—



You'll Find Type "C" Ace Drills More Efficient

Only through Ace Drill Corporation's unique "ground from the solid" process is the solid carbide twist drill possible.

Ace TYPE "C" Drills are solid carbide and are constructed with a heavy web and fast spiral, polished flutes to assure you peak efficiency when drilling abrasive non-ferrous metals and plastics.

The economy of using solid carbide twist drills is evident in the continuous production possible with these harder, more wear-resistant drills.

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★ WRITE FOR THE DESCRIPTIVE FOLDER ★

ACE DRILL CORPORATION

MANUFACTURERS OF GROUND-FROM-THE-SOLID DRILLS AND REAMERS

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